CITY OF ROCKVILLE

TRANSPORTATION NOISE STUDY
FINAL REPORT

April 15, 2005

Prepared for

City of Rockville, Maryland

Prepared by

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Executive Summary

This transportation noise study assesses the existing transportation noise environment, recommends transportation noise mitigation analysis, and recommends transportation noise control regulatory mechanisms for the City of Rockville, Maryland.

Noise measurements were performed throughout the City from Thursday, September 23, 2004 through Wednesday, November 03, 2004 to evaluate existing noise levels and to form a basis from which to predict residential noise impacts resulting from transportation facilities within City limits. The study concentrates on residential areas where noise issues had been brought to the attention of City staff by residents, as well as residential areas deemed adjacent to major transportation corridors, and includes the following locations:

- Carter Road & Leverton Road (Hungerford)
- College Gardens
- Glenora Hills (Glenora Hills, Griffith Oaks, Rockshire)
- West End (Nelson Street)
- Norbeck Road (Burgundy Knolls, Charles Walk, East Rockville, Maryvale, Redgate Farms)
- Norbeck Road (Burgundy Estates, Silver Rock, Twinbrook Forest)
- North Farm
- North Stonestreet Avenue – Frederick Avenue (Lincoln Park)
- Twinbrook (Rockcrest Courts, NW Twinbrook)
- Twinbrook (SE Twinbrook)
- Watts Branch Parkway – Rose Hill Development (Fallswood, Rockshire, Rose Hill, Rose Hill Falls)

The City of Rockville's noise impact criterion was determined through collaborative effort with the City of Rockville's Environmental Commission, the City of Rockville's Traffic & Transportation Commission, and Rummel, Klepper & Kahl, LLP. The selected noise impact criterion was a 66 A-weighted decibels (66dBA) equivalent sound level (L_{eq}). This criterion is commonly used for determining transportation noise impacts in residential areas, and is the practical criterion for Federal Highway Administration (FHWA), Maryland State Highway Administration (MDSHA), Virginia Department of Transportation (VDOT), and Delaware Department of Transportation (DelDOT), among other state and local agencies.

Additional analysis of the City's overall noise environment was completed for residential neighborhoods outside of the eleven study areas listed above. Noise impacts were estimated based upon proximity to common transportation noise sources, common topography, and common noise mitigation systems. Need for further, detailed noise mitigation analysis was identified for the following transportation noise sources:

- CSX / Metro Rail (North Stonestreet Avenue, Frederick Avenue, Twinbrook)
- Interstate 270 (West End Park)
- Norbeck Road / First Street (Burgundy Estates, Burgundy Knolls, Charles Walk, East Rockville, Maryvale, Redgate Farms, Silver Rock, Twinbrook)
- Veirs Mill Road (Twinbrook)

Finally, in recognition of the City's growing need to address transportation noise, it is recommended that the City adopt a Comprehensive Transportation Noise Policy that includes a transportation noise complaint response procedure, a proactive transportation noise analysis mechanism, and transportation noise mitigation guidelines.

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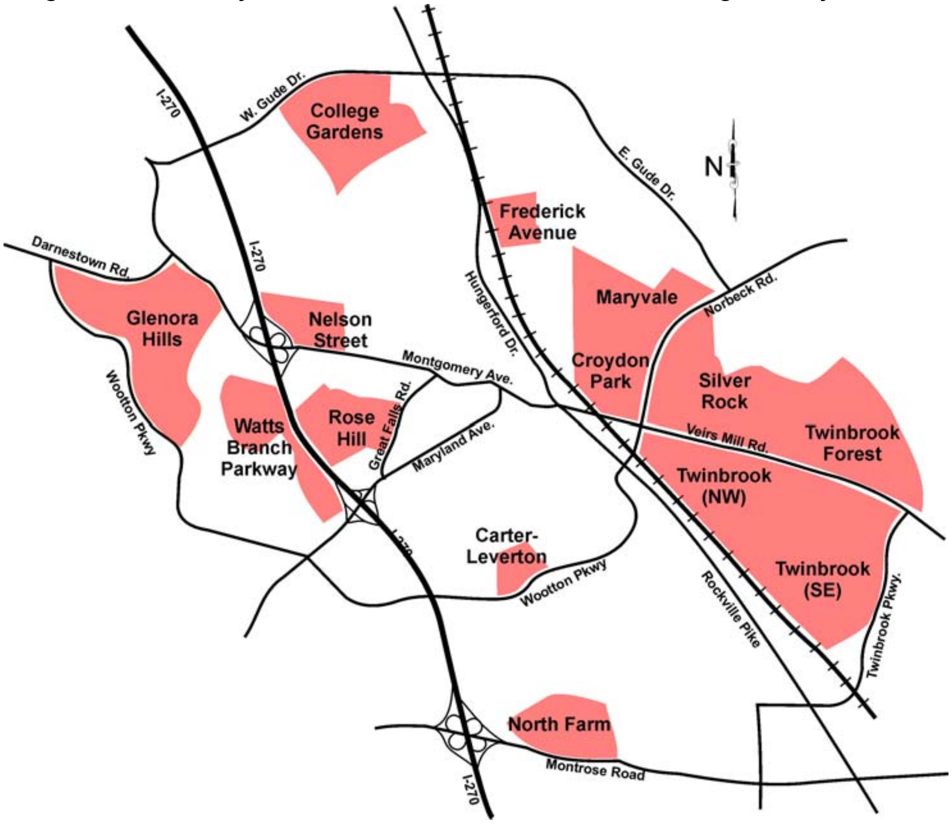
1. Introduction

Project Description

This report presents the results of noise monitoring and analysis completed in several residential neighborhoods throughout the City of Rockville, MD between Thursday, September 23, 2004 and Wednesday, November 03, 2004. These study areas are shown shaded in Figure 1.1: City of Rockville Noise Monitoring Study Areas, below. This report also presents a comparative analysis of measured and estimated loudest-hour highway traffic and rail transit noise levels throughout the City limits. Finally, this report presents a conclusive statement regarding the overall transportation noise environment throughout the City, recommendations for transportation noise mitigation analysis, and recommendations for transportation noise control regulatory mechanisms.

Figure 1.1: City of Rockville Noise Monitoring Study Areas



Common Indoor and Outdoor Noise Levels

To correlate noise environments with community annoyance, a single-number noise descriptor called the equivalent sound level, L_{eq}, is commonly used. The L_{eq} is the value or level of a steady, non-fluctuating sound that represents the same amount of acoustical energy over a period of time as fluctuating sound over the same period of time. For traffic noise assessment, L_{eq} is typically evaluated over a one-hour period, and is denoted as $L_{eq(h)}$. Many agencies such as the Federal Highway Administration and many neighboring departments of transportation utilize the $L_{eq(h)}$ descriptor for noise analysis. As a point of reference, Table 1.1, below, shows several common sound levels from indoor and outdoor noise sources.

Table 1.1
Common Indoor and Outdoor Noise Levels

Common Outdoor Noise Levels	Noise Level (dBA)	Common Indoor Noise Levels
	110	Rock Band
Jet Flyover at 1,000 feet	100	Inside Subway Train (NY)
Gas Lawn Mower at 3 feet		
Diesel Truck at 50 feet	90	Food Blender at 3 feet
Noisy Urban Daytime	80	Garbage Disposal at 3 feet
Gas Lawn Mower at 100 feet	70	Vacuum Cleaner at 10 feet
Commercial Area		Normal Speech at 3 feet
	60	
		Large Business Office
Quiet Urban Daytime	50	Dishwasher Next Room
Quiet Urban Nighttime	40	Small Theater, Large Conference Room (Background)
Quiet Suburban Nighttime		Library
	30	
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (Background)
	20	
		Broadcast & Recording Studio
	10	Threshold of Hearing
	0	

Adapted from Guide on Evaluation and Attenuation of Traffic Noise, AASHTO. 1974 (revised 1993).

City of Rockville Transportation Noise Impact Criterion

The most commonly used criterion for determining transportation noise impacts in residential areas is the loudest-hour equivalent sound level of sixty-six A-weighted decibels ($L_{eq(h)}$ = 66dBA). As shown in Table 1.1, above, 66dBA is approximately the sound level of normal speech at a distance of three feet, or approximately the sound level of a commercial area (outdoors). For 24-hour monitoring sessions, the loudest-hour equivalent sound level is the highest one-hour logarithmic average sound level over any whole-hour period.

For short-term monitoring sessions, the loudest-hour equivalent sound level is calculated by adjusting the short-term equivalent sound level by the number of decibels separating the equivalent sound level obtained at the nearest[1] 24-hour receptor at the same time interval as the short-term monitoring data and the loudest-hour equivalent sound level obtained at the nearest 24-hour receptor.[2]

[1] The "nearest" 24-hour sound level monitoring location refers to the 24-hour receptor that obtained data with the highest statistical correlation, ρ, to the short-term monitoring data over the short-term monitoring session time interval.

[2] For example, if the L_{eq} at the "nearest" 24-hour receptor between 11:00 a.m. and 11:20 a.m. = 63dBA, but the loudest-hour L_{eq} at the "nearest" 24-hour receptor = 65dBA, then an equivalent sound level obtained at a correlating short-term receptor between 11:00 a.m. and 11:20 a.m. would be adjusted +2dBA (65dBA – 63dBA) to obtain the loudest-hour equivalent sound level ($L_{eq(h)}$) at the short-term receptor.

On Tuesday, November 16, 2004 the City of Rockville's Environmental Commission, the City of Rockville's Traffic & Transportation Commission, and representatives from Rummel, Klepper & Kahl, LLP met to discuss the procedures associated with the noise monitoring effort, the preliminary results and to define a noise level impact threshold. Following a discussion on the definition of transportation noise, impact criteria of adjacent governmental agencies, including Federal Highway Administration, Maryland State Highway Administration, Montgomery County and the Maryland National Capital Park and Planning Commission, the City's Commissions agreed to use the 66dBA loudest-hour equivalent sound level ($L_{eq(h)}$ = 66dBA) as the criterion for transportation noise impacts in exterior residential areas.

2. Noise Measurements

Noise measurements of the City of Rockville study area and classified traffic counts were completed in several noise monitoring sessions on each day noise monitoring data were obtained. All 24-hour noise monitoring data were obtained using Rion NL-06 Type 2 noise level meters; all short-term noise monitoring data were obtained using Metrosonics DB3080 Type 2 noise level meters. Microphones were set approximately 5 feet above ground elevation and oriented toward the dominant noise source for each monitoring location.

2.1 Carter Road & Leverton Road (Hungerford)

The Carter Road & Leverton Road (Hungerford) study area consists of the southern end of the Hungerford neighborhood north of Wootton Parkway and east of Dogwood Park, as shown in Figure 2.1: Carter Road & Leverton Road (Hungerford) Study Area and Monitoring Locations, below:

Figure 2.1: Carter Road & Leverton Road (Hungerford)
Study Area and Monitoring Locations

The dominant noise source at the intersection of Carter Road and Leverton Road is Wootton Parkway, which is elevated with respect to the 800 block of Leverton Road. Twenty-four hour noise monitoring data were obtained at three locations in the study area: at the intersection of Carter Road and Leverton Road, 811 Leverton Road, and 100’ south of Leverton Road. Short-term noise monitoring data were obtained at two locations in the study area: 807 Leverton Road and 801 Leverton Road.

Table 2.1 – Noise Monitoring Data (dBA): Carter Road & Leverton Road (Hungerford)							
Location	**$L_{eq(h)}$**	**L_{max}**	**L_{10}**	**L_{90}**	**L_{dn}**	**L_{eq24h}**	**Comment**
1. Carter & Leverton	59	79	61	56	60	55	24-hr farthest from Wootton Pkwy
2. 811 Leverton	59	74	61	57	61	56	24-hr
3. 100' S of Leverton	60	73	62	57	62	57	24-hr at nearest lot-line to source
4. 801 Leverton*	54*	67	60*	52*	N/A	N/A	Short-term
5. 807 Leverton*	55*	70	58*	52*	N/A	N/A	Short-term
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.							
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Carter & Leverton*							

Noise monitoring data obtained at the nearest property lot line indicated a loudest-hour equivalent sound level, $L_{eq(h)}$ = 60dBA, below the 66dBA noise impact criterion. The statistical correlation between 24-hour monitoring data across the study area is very strong (ρ_{Leq} = 0.9, ρ_{Lmax} = 0.8, ρ_{L10} = 0.9, ρ_{L90} = 0.9), indicating that a common noise source (Wootton Parkway) dominates the overall noise condition.

Although Wootton Parkway dominates the overall noise condition, the noise monitoring data did not identify any noise impacts in the Carter Road & Leverton Road study area.

2.2 College Gardens

The College Gardens Study area consists of the College Gardens Neighborhood south of West Gude Drive, west of Yale Place, and north of College Parkway, as shown in Figure 2.2: College Gardens Study Area and Monitoring Locations, below:

Figure 2.2: College Gardens Study Area and Monitoring Locations

The dominant noise source to the College Gardens study area is West Gude Drive. Twenty-four hour noise monitoring data were obtained at two locations in the study area: 1304 Princeton Place, and at the top of the earth berm at the north end of Yale Place. Short-term noise monitoring data were obtained at four locations in the study area: the north end of Yale Place hiker-biker path, the intersection of Yale Place and Fordham Street, the intersection of College Parkway and Princeton Place, and the intersection of Princeton Place and Baylor Avenue.

Table 2.2 – Noise Monitoring Data (dBA): College Gardens

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
1. 1304 Princeton Place	57	69	59	55	58	53	24-hr
2. Yale St – top of berm	71	91	74	64	71	68	24-hr
3. Yale St – H-B path	57*	64	60*	53*	N/A	N/A	Short-term
4. Yale & Fordham	53*	69	58*	50*	N/A	N/A	Short-term
5. College & Princeton	65**	87	72**	53**	N/A	N/A	Short-term
6. Baylor & Princeton	54**	72	58*	49**	N/A	N/A	Short-term

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.

**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Yale Place – top of berm*

***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 1304 Princeton Place*

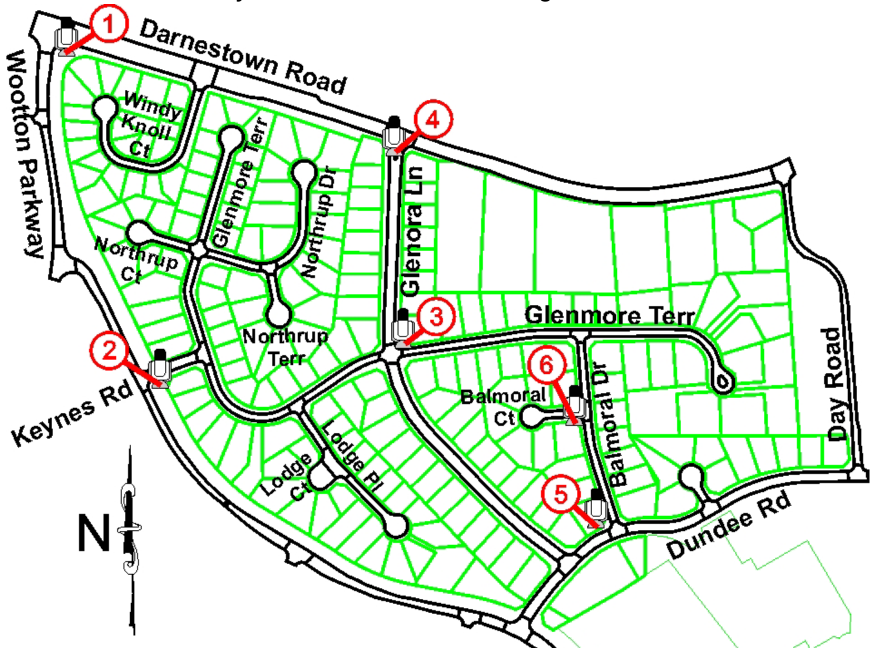
Noise monitoring data obtained at the nearest property lot line indicated a loudest-hour equivalent sound level, $L_{eq(h)}$ = 57dBA, below the 66dBA noise impact criterion. The noise monitoring data shows an approximate 14dBA insertion loss from the West Gude Drive earth berm. The statistical correlation between 24-hour monitoring $L_{eq(h)}$, L_{10}, and L_{90} data across the study area is strong. However, maximum sound levels at 1304 Princeton Place have little correlation to maximum sound levels at the top of the West Gude Drive earth berm ($\rho_{Leq} = 0.9$, $\rho_{Lmax} = 0.3$, $\rho_{L10} = 0.9$, $\rho_{L90} = 0.8$). This indicates that a common noise source (West Gude Drive) dominates the overall noise condition throughout the northern end of College Gardens, but that noise sources that create the loudest short-term noise events at the top of the berm do not create the loudest short-term noise events at 1304 Princeton Place.

The noise monitoring data did not identify any noise impacts in the College Gardens study area.

2.3 Glenora Hills (Glenora Hills, Griffith Oaks, Rockshire)

The Glenora Hills study area consists of the northern sections of the Glenora Hills, Griffith Oaks, and Rockshire neighborhoods south of Darnestown Road and east of Wootton Parkway, as shown in Figure 2.3: Glenora Hills (Glenora Hills, Griffith Oaks, Rockshire) Study Area and Monitoring Locations, below:

Figure 2.3: Glenora Hills (Glenora Hills, Griffith Oaks, Rockshire) Study Area and Monitoring Locations



The dominant noise sources to the Glenora Hills study area are Darnestown Road and Wootton Parkway. Twenty-four hour noise monitoring data were obtained at two locations in the study area: the intersection of Wootton Parkway and Darnestown Road, and the intersection of Wootton Parkway and Keynes Road. Short-term noise monitoring data were obtained at four locations in the study area: the intersection of Glenora Lane and Glenmore Terrace, the intersection of Glenora Lane and Darnestown Road, the intersection of Balmoral Drive and Dundee Road, and the intersection of Balmoral Drive and Balmoral Court.

Table 2.3 – Noise Monitoring Data (dBA): Glenora Hills (Glenora Hills, Griffith Oaks, Rockshire)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
1. Wootton & Darnestown	71	88	74	67	70	67	24-hr. Top of berm
2. Wootton & Keynes	65	82	69	59	64	61	24-hr. Lot line on Keynes Rd.
3. Glen. Ln & Glnmr. Terr	54*	77	61*	46*	N/A	N/A	Short-term
4. Glenora & Darnestown	76*	87	79*	66*	N/A	N/A	Short-term
5. Balmoral Dr. & Dundee	55**	70	60**	46**	N/A	N/A	Short-term
6. Balmoral Dr. & Ct.	48**	68	52**	45**	N/A	N/A	Short-term

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Wootton Parkway & Darnestown Road*
***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Wootton Parkway & Keynes Road*

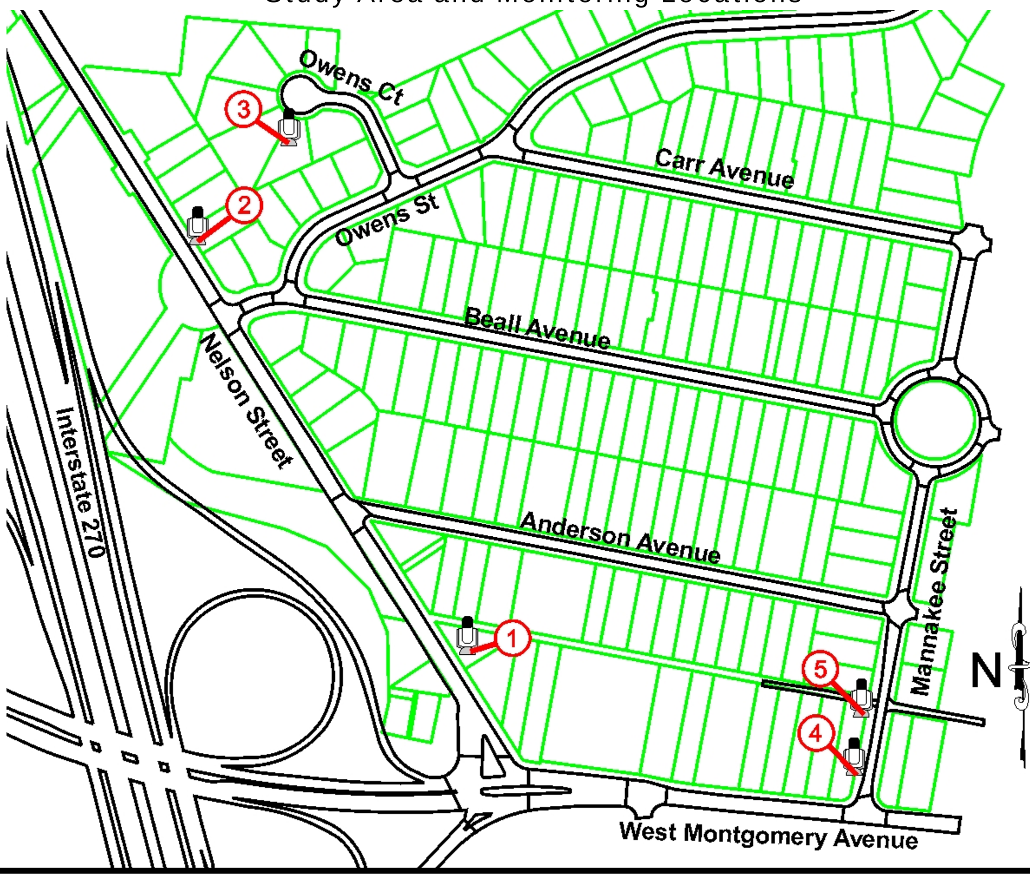
Noise monitoring data obtained at the nearest property lot line indicated a loudest-hour equivalent sound level, $L_{eq(h)}$ = 76dBA at the intersection of Glenora Lane and Darnestown Road. The statistical correlation between 24-hour monitoring data across the study area is strong (ρ_{Leq} = 1.0, ρ_{Lmax} = 0.7, ρ_{L10} = 1.0, ρ_{L90} = 0.8), indicating that noise along Wootton Parkway and noise along Darnestown Road fluctuates almost identically throughout the day. The noise monitoring data identified noise impacts in the study area along Glenora Lane in the vicinity of Darnestown Road.

The noise monitoring data did not identify any noise impacts along Wootton Parkway or within the interior sections of the Glenora Hills study area.

2.4 West End (Nelson Street)

The Nelson Street study area consists of the southwestern section of the West End Park neighborhood north of West Montgomery Avenue, west of Mannakee Street, and east of Interstate 270, as shown in Figure 2.4: West End (Nelson Street) Study Area and Monitoring Locations, below:

Figure 2.4: West End (Nelson Street)
Study Area and Monitoring Locations



The dominant noise source to the West End (Nelson Street) study area is Interstate 270. Twenty-four hour noise monitoring data were obtained at three locations in the study area: 5 Nelson Street, 203 Nelson Street, and 9 Owens Court. Short-term noise monitoring data were obtained at two locations in the study area: the intersection of Mannakee Street 50' north of West Montgomery Avenue, and Mannakee Street 200' north of West Montgomery Avenue.

Table 2.4 – Noise Monitoring Data (dBA): West End (Nelson Street)							
Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	**Comment**
1. 5 Nelson St.	70	83	72	66	69	65	24-hour
2. 203 Nelson St.	76	88	77	74	74	71	24-hour
3. 9 Owens Ct.	69	83	72	64	71	66	24-hour
4. Mannakee – 50' N	66*	77	69*	63*	N/A	N/A	Short-term
5. Mannakee – 200' N	62*	76	67*	54*	N/A	N/A	Short-term
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.							
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 5 Nelson Street.*							

Noise monitoring data obtained at the nearest property lot line indicated a loudest-hour equivalent sound level, $L_{eq(h)}$ = 76dBA at 203 Nelson Street, significantly above the 66dBA noise impact criterion. The statistical correlation between 24-hour monitoring $L_{eq(h)}$, L_{10}, and L_{90} data across the study area is strong. However, maximum sound levels had little correlation (ρ_{Leq} = 0.9, ρ_{Lmax} = 0.3, ρ_{L10} = 1.0, ρ_{L90} = 0.9), indicating that a common noise source (Interstate 270) dominates the overall noise condition throughout the entire study area, and that noise sources that create the loudest short-term noise events at 5 Nelson Street do not create the loudest short-term noise events at 203 Nelson Street. The data support the conclusion that although Interstate 270 traffic noise dominates the overall sound environment along Nelson Street in its entirety, West Montgomery Avenue traffic noise provides maximum sound levels to the southernmost residences of Nelson Street.

The noise monitoring data identified noise impacts along West Montgomery Avenue, along Nelson Street, and for homes in the West End neighborhood within approximately 400 feet of Interstate 270.

2.5 Norbeck Road (Burgundy Knolls, Charles Walk, East Rockville, Maryvale, Redgate Farms)

The Norbeck Road (Burgundy Knolls, Charles Walk, East Rockville, Maryvale, Redgate Farms) study area consists of the residential areas southwest of East Gude Drive, north and west of Norbeck Road / First Street, and north of Veirs Mill Road, as shown in Figure 2.5: Norbeck Road (Burgundy Knolls, Charles Walk, East Rockville, Maryvale, Redgate Farms) Study Area and Monitoring Locations, below:

Figure 2.5: Norbeck Road (Burgundy Knolls, Charles Walk, East Rockville, Maryvale, Redgate Farms) Study Area and Monitoring Locations

The dominant noise source to the study area north and west of First Street/Norbeck Road is the highway itself. Twenty-four hour noise monitoring data were obtained at three locations in the study area: Maryvale Park, the intersection of First Street and Norbeck Road, and the intersection of Grandin Avenue and First Street. Short-term noise monitoring data were obtained at four locations in the study area: 803 Grandin Avenue, 704 Grandin Avenue, the intersection of Baltimore Road and Grandin Avenue, and the intersection of Grandin Avenue and Croydon Avenue.

Table 2.5 – Noise Monitoring Data (dBA): Norbeck Road (Burgundy Knolls, Charles Walk, East Rockville, Maryvale, Redgate Farms)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
1. Maryvale Park	55	70	58	53	56	51	24-hour
2. First St & Norbeck	74	96	78	67	75	71	24-hour
3. Grandin & First St.	71	84	72	71	68	65	24-hour
4. 803 Grandin	61*	69	65*	58*	N/A	N/A	Short-term
5. 704 Grandin	54*	69	56*	52*	N/A	N/A	Short-term
6. Baltimore & Grandin	63*	79	70*	51*	N/A	N/A	Short-term
7. Croydon & Grandin	50*	67	54*	45*	N/A	N/A	Short-term

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Grandin Avenue and Norbeck Road.*

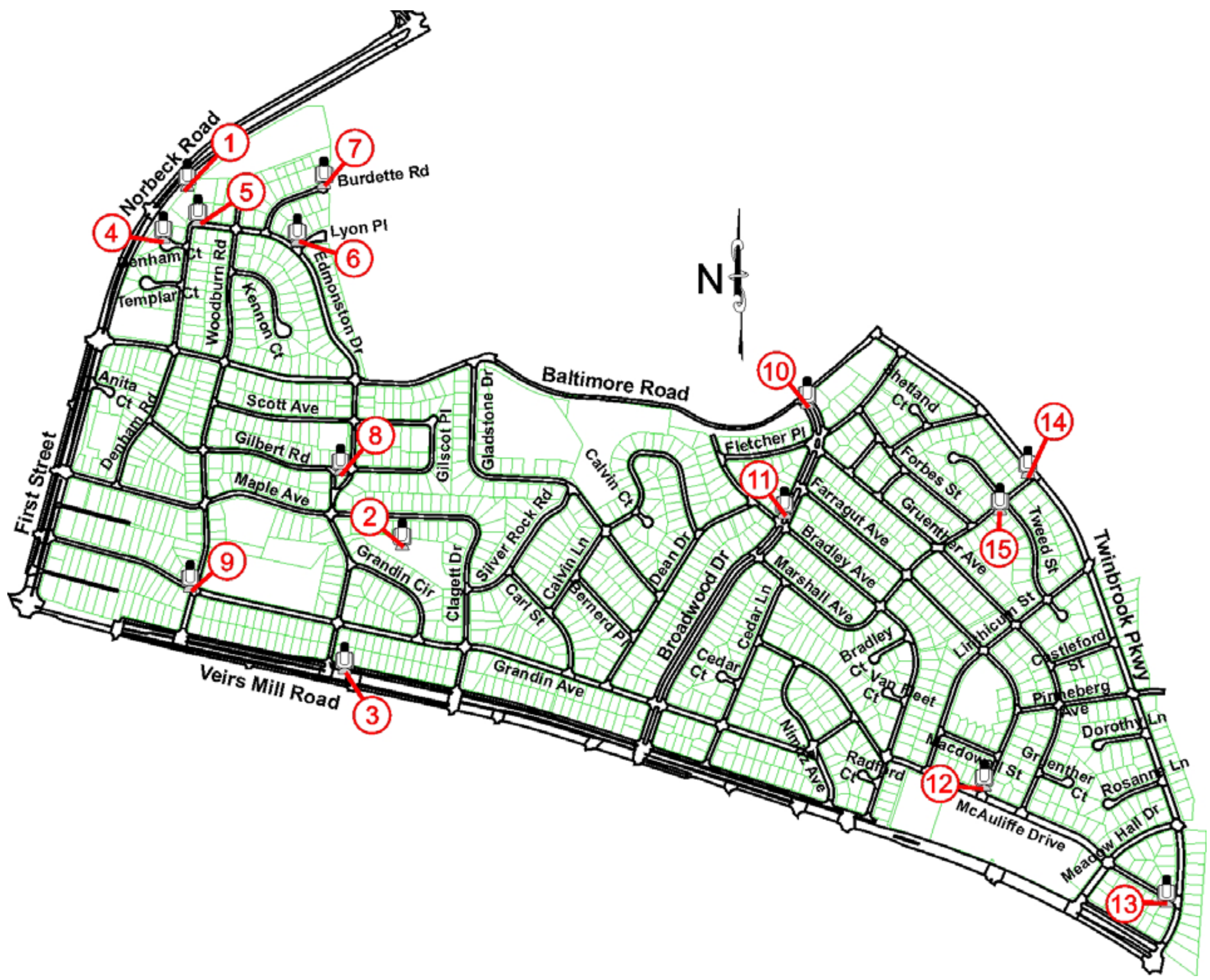
Noise monitoring data obtained at the nearest property lot line indicated a loudest-hour equivalent sound level, $L_{eq(h)}$ = 71dBA for first-row residences north of Norbeck Road, above the 66dBA noise impact criterion. The statistical correlation between 24-hour monitoring data in the near vicinity of Norbeck Road is strong, (ρ_{Leq} = 0.8, ρ_{Lmax} = 0.7, ρ_{L10} = 0.9, ρ_{L90} = 0.7), indicating that Norbeck Road is the dominant noise source up to a distance of approximately 300 feet. However, since the loudest-hour equivalent sound level at Maryvale Park, $L_{eq(h)}$ = 55dBA, noise from Norbeck Road does not create noise impacts far from Norbeck Road. Furthermore, short-term monitoring at the intersection of Baltimore Road and Grandin Avenue indicates that local daytime traffic creates noise impacts to first-row residences along Baltimore Road.

The noise monitoring data identified noise impacts along First Street, and along Grandin Avenue, Baltimore Road, Robert Road, Maple Avenue, and Reading Avenue.

2.6 Norbeck Road and Veirs Mill Road (Burgundy Estates, Silver Rock, NE Twinbrook, Twinbrook Forest)

The Norbeck Road and Veirs Mill Road (Burgundy Estates, Silver Rock, NE Twinbrook, Twinbrook Forest) study area consists of the residential areas south and east of Norbeck Road / First Street, north of Veirs Mill Road, south of Baltimore Road, and west of Twinbrook Parkway, as shown in Figure 2.6: Norbeck Road (Burgundy Estates, Silver Rock, NE Twinbrook, Twinbrook Forest) Study Area and Monitoring Locations, below:

Figure 2.6: Norbeck Road and Veirs Mill Road (Burgundy Estates, Silver Rock, NE Twinbrook, Twinbrook Forest) Study Area and Monitoring Locations



The dominant noise source to the study area southeast of Norbeck Road is Norbeck Road. Twenty-four hour noise monitoring data were obtained at three locations in the study area: 624 Denham Road adjacent to Norbeck Road, Silver Rock Park, and the intersection of Veirs Mill Road and Edmonston Drive. Short-term noise monitoring data were obtained at twelve locations in the study area: Denham

Court, the intersection of Edmonston Drive and Denham Road, the intersection of Edmonston Drive and Lyon Place, Burdette Road, the intersection of Edmonston and Gilbert Road, the intersection of Woodburn Road and Grandin Avenue, Broadwood Drive and Baltimore Road, Broadwood Drive and Bradley Avenue, McAuliffe Drive and Farragut Avenue, McAuliffe Drive and Twinbrook Parkway, Marshall Avenue and Twinbrook Parkway, and Marshall Avenue and Tweed Street.

Table 2.6 – Noise Monitoring Data (dBA): Norbeck Road and Veirs Mill Road (Burgundy Estates, Silver Rock, NE Twinbrook, Twinbrook Forest)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
1. 624 Denham Road	66	88	69	61	67	64	24-hour
2. Silver Rock Park	53	69	56	51	52	48	24-hour
3. Veirs Mill & Edmnstn.	73	91	76	67	75	71	24-hour
4. Denham Court	60*	70	63*	57*	N/A	N/A	Short-term
5. Edmonston & Denham	62*	73	64*	58*	N/A	N/A	Short-term
6. Edmonston & Lyon	54*	65	59*	51*	N/A	N/A	Short-term
7. Burdette Road	53*	57	54*	51*	N/A	N/A	Short-term
8. Edmonston & Gilbert	55*	65	59*	50*	N/A	N/A	Short-term
9. Woodburn & Grandin	55**	67	59**	49**	N/A	N/A	Short-term
10. Broadwood & Balt.	60	76	65	47	N/A	N/A	Short-term
11. Broadwood & Bradley	55	73	62	46	N/A	N/A	Short-term
12. McAuliffe & Farragut	58**	74	63**	53**	N/A	N/A	Short-term
13. McAuliffe & Twnbrk.	69**	83	73**	63**	N/A	N/A	Short-term
14. Marshall & Twnbrk.	64**	78	68**	55**	N/A	N/A	Short-term
15. Marshall & Tweed	53**	68	56**	49**	N/A	N/A	Short-term

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 624 Denham Road*
***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Veirs Mill Road & Edmonston Drive*

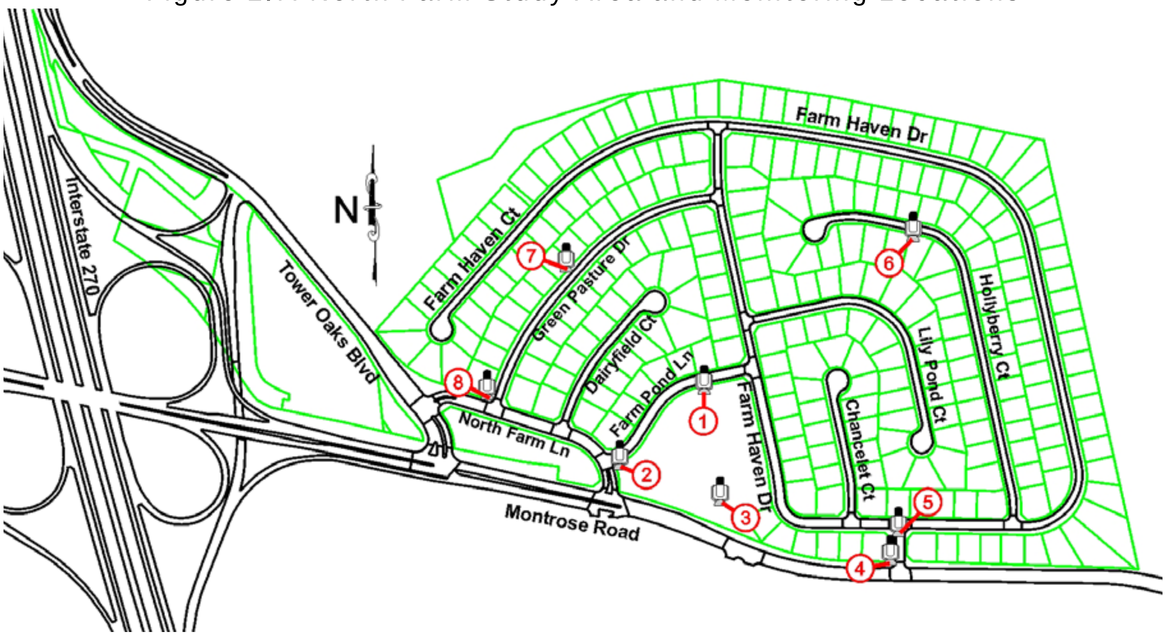
Noise monitoring data obtained at the nearest property lot line indicated a loudest-hour equivalent sound level, $L_{eq(h)}$ = 73dBA at for first-row residences north of Veirs Mill Road, above the 66dBA noise impact criterion. Adjacent to Norbeck Road, noise monitoring data obtained at the nearest property lot line indicated a loudest-hour equivalent sound level, $L_{eq(h)}$ = 66dBA, equal to the 66dBA noise impact criterion. The statistical correlation between 24-hour monitoring data obtained adjacent to Norbeck Road and adjacent to Veirs Mill Road was strong (ρ_{Leq} = 0.9, ρ_{Lmax} = 0.6, ρ_{L10} = 0.9, ρ_{L90} = 1.0), indicating that traffic noise on Norbeck Road and Veirs Mill road fluctuates similarly throughout the hours of the day.

The noise monitoring data obtained throughout the study area identified noise impacts along Veirs Mill Road, as well as to first-row residences along Twinbrook Parkway near Veirs Mill Road.

2.7 North Farm

The North Farm study area consists of the North Farm Neighborhood north of Montrose Road and East of Interstate 270, as shown in Figure 2.7: North Farm Study Area and Monitoring Locations, below:

Figure 2.7: North Farm Study Area and Monitoring Locations



The dominant noise source to the North Farm study area is Montrose Road. Twenty-four hour noise monitoring data were obtained at three locations in the study area: 610 Farm Pond Lane, Farm Haven Park, and at the entrance to the North Farm neighborhood at the intersection of Montrose Road and North Farm Lane. Short-term noise monitoring data were obtained at five locations in the study area: Montrose Road and Farm Haven Drive, 1021 Farm Haven Drive, 30 Hollyberry Court, 416 Green Pasture Drive, and 400 Green Pasture Drive.

Table 2.7 – Noise Monitoring Data (dBA): North Farm

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
1. 610 Farm Pond Lane	61	88	65	56	60	55	24-hour
2. North Farm & Mont	68	82	70	65	70	66	24-hour
3. N. Farm Pk. Tennis Ct	64	78	67	61	66	62	24-hour
4. Mont & Farm Haven	75*	89	79*	70*	N/A	N/A	Short-term
5. 1021 Farm Haven	64*	79	68*	57*	N/A	N/A	Short-term
6. 30 Hollyberry	57**	66	61**	54**	N/A	N/A	Short-term
7. 416 Green Pasture	55**	70	59**	51**	N/A	N/A	Short-term
8. 400 Green Pasture	63*	82	66*	60*	N/A	N/A	Short-term

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at North Farm Lane and Montrose Road.*
***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 610 Farm Pond Lane*

Noise monitoring data obtained at the nearest property lot line indicated a loudest-hour equivalent sound level, $L_{eq(h)}$ = 75dBA for first-row residences north of Montrose Road, significantly above the 66dBA noise impact criterion. With the exception of L_{max} data, the statistical correlation between 24-hour monitoring data obtained approximately 100 feet north of Montrose Road and approximately 500 feet north at 610 Farm Pond Lane is strong (ρ_{Leq} = 0.8, ρ_{Lmax} = 0.2, ρ_{L10} = 0.7, ρ_{L90} = 0.8), indicating that although Montrose Road traffic noise is the dominant noise source throughout the study area, localized single noise events do occur within the neighborhood.

Noise monitoring data obtained throughout the study area identified noise impacts to first-row residences adjacent to Montrose Road, as well as noise impacts to second-row residences with unobstructed path to (view of) Montrose Road.

2.8 North Stonestreet Avenue – Frederick Avenue (Lincoln Park)

The North Stonestreet Avenue – Frederick Avenue (Lincoln Park) study area consists of the area east of the CSX / Metro rail right-of-way between Lincoln Avenue and Ashley Avenue, as shown in Figure 2.8: North Stonestreet Avenue – Frederick Avenue (Lincoln Park) Study Area and Monitoring Locations, below:

Figure 2.8: North Stonestreet Avenue – Frederick Avenue (Lincoln Park) Study Area and Monitoring Locations

The dominant noise sources to the North Stonestreet Avenue – Frederick Avenue (Lincoln Park) study area are the CSX and Metro rail lines. Twenty-four hour noise monitoring data were obtained at three locations in the study area: the western end of Frederick Avenue (nearest residential property lot-line), 112 Frederick Avenue, and the intersection of North Stonestreet Avenue and Ashley Avenue. Short-term noise monitoring data were obtained at four locations in the study area: 916 North Stonestreet Avenue – 100’ west of the edge of pavement, 916 North Stonestreet Avenue – 200’ west of the edge of pavement, 610 Douglas Avenue, and the intersection of Douglas Avenue and Spring Avenue.

Table 2.8 – Noise Monitoring Data (dBA): North Stonestreet Avenue - Frederick Avenue (Lincoln Park)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
1. Frederick Ave – end	84	112	87	77	85	78	24-hour
2. 112 Frederick Ave	66	88	69	59	68	61	24-hour
3. N Stonestreet & Ashley	61	78	64	58	62	56	24-hour
4. 916 N Stonestreet+100	60*	68	62*	58*	N/A	N/A	Short-term
5. 916 N Stonestreet+200	63**	69	66**	60**	N/A	N/A	Short-term
6. 610 Douglas Ave	57	76	61	50	N/A	N/A	Short-term
7. Douglas & Spring	53	70	58	48	N/A	N/A	Short-term

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at North Stonestreet Avenue and Ashley Avenue.*
***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at the west end of Frederick Avenue.*

Noise monitoring data obtained at the nearest property lot line indicated a loudest-hour equivalent sound level, $L_{eq(h)}$ = 84dBA for first-row residences adjacent to CSX and Metro rail lines, above the 66dBA noise impact criterion. The statistical correlation between 24-hour monitoring data obtained at the western end of Frederick Avenue and 112 Frederick Avenue is strong ($\rho_{Leq} = 0.8$, $\rho_{Lmax} = 0.7$, $\rho_{L10} = 0.7$, $\rho_{L90} = 0.8$), indicating that the same noise source that creates the severe impacts to the residential properties adjacent to the rail lines also creates noise impacts to residential properties approximately 200' east. Transportation noise impacts to these residences result from rail transit, not from traffic noise. Since rail transit is periodic and urban/suburban traffic along primary corridors and highways is generally continuous, similar hourly equivalent sound levels from rail transit noise sources and automobile and truck traffic noise sources do not usually represent similar degrees of noise annoyance. The noise environment adjacent to the rail facility will generally be more annoying because its noise levels fluctuates more than noise levels adjacent to primary corridors and highways.[3]

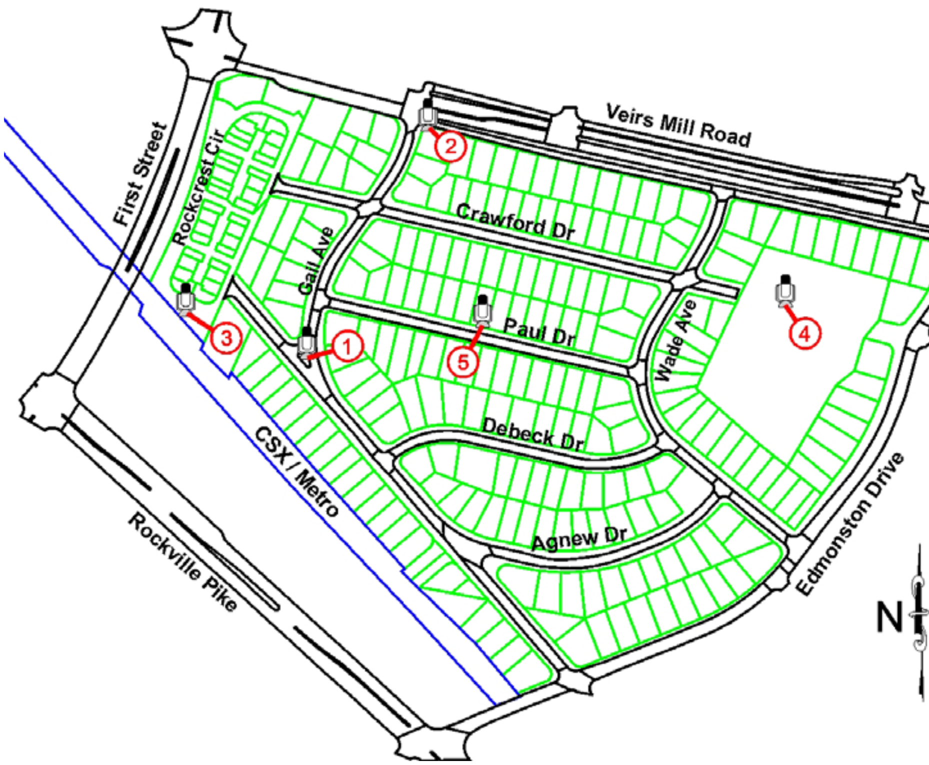
Noise monitoring data obtained throughout the study area identified noise impacts to the residences in the 100-block of Frederick Avenue, and to the even-numbered residences along the west side of North Stonestreet Avenue.

[3] Harris, Cyril M., Ph.D. Handbook of Noise Control. McGraw-Hill, New York, 1979, p16-5.

2.9 Twinbrook (Rockcrest Courts, NW Twinbrook)

The Twinbrook (Rockcrest Courts, NW Twinbrook) study area consists of the area northeast of the CSX / Metro rail right-of-way, south of Veirs Mill Road, east of First Street and west of Edmonston Drive, as shown in Figure 2.9: Twinbrook (Rockcrest Courts, NW Twinbrook) Study Area and Monitoring Locations, below:

Figure 2.9: Twinbrook (Rockcrest Courts, NW Twinbrook) Study Area and Monitoring Locations



The dominant noise sources to the Twinbrook (Rockcrest Courts, NW Twinbrook) study area are the CSX and Metro rail lines to the southwest, and Veirs Mill Road to the north. Twenty-four hour noise monitoring data were obtained at three locations in the study area: Lewis Avenue and Gail Avenue, Veirs Mill Road and Gail Avenue, and Rockcrest Circle at the CSX / Metro Rail right-of-way fence. Short-term noise monitoring data were obtained at two locations in the study area: Hillcrest Park and 1010 Paul Drive.

Table 2.9 – Noise Monitoring Data (dBA): Twinbrook (Rockcrest Courts, NW Twinbrook)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
1. Lewis & Gail	59	82	64	55	63	57	24-hour
2. Veirs Mill & Gail	81	100	85	70	78	75	24-hour
3. Rockcrest & RR	83	115	83	71	80	75	24-hour
4. Hillcrest Park	59*	70	62*	56*	N/A	N/A	Short-term
5. 1010 Paul Drive	53*	59	53*	52*	N/A	N/A	Short-term

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Lewis Avenue and Gail Avenue.*

Noise monitoring data obtained at the properties adjacent to the CSX – Metro Rail lines indicates that these properties are impacted, with a loudest-hour equivalent sound level, $L_{eq(h)}$ = 83dBA, above the 66dBA noise impact criterion. Noise monitoring data obtained at the properties adjacent to the eastbound lanes of Veirs Mill Road are also severely impacted, with a loudest-hour equivalent sound level, $L_{eq(h)}$ = 81dBA, also greater than the 66dBA noise impact criterion. There is no statistical correlation between 24-hour monitoring data obtained at the intersection of Veirs Mill Road and Gail Avenue and Rockcrest Circle at the CSX / Metro Rail right-of-way fence ($\rho_{Leq} = -0.2$, $\rho_{Lmax} = -0.2$, $\rho_{L10} = -0.1$, $\rho_{L90} = -0.4$), indicating that the two dominant noise sources are unrelated, and create noise impacts to the study area independently of each other. The rail transit noise impacts along the odd-numbered Lewis Avenue residences adjacent to the CSX / Metro Rail lines experience greater noise annoyance due to the periodic passage of trains over the rail lines than do the impacted residences along Veirs Mill Road that are exposed to constant automobile/truck traffic noise.

Noise monitoring data obtained throughout the study area identified noise impacts along Veirs Mill Road, to the odd-numbered homes along Lewis Avenue, and to the homes along Rockcrest Circle adjacent to First Street.

2.10 Twinbrook (SE Twinbrook)

The Twinbrook (SE Twinbrook) study area consists of the area northeast of the CSX / Metro rail right-of-way, south of Veirs Mill Road, southeast of Edmonston Drive, northwest of Halpine Road, and west of Twinbrook Parkway, as shown in Figure 2.10: Twinbrook (SE Twinbrook) Study Area and Monitoring Locations, below:

Figure 2.10: Twinbrook (SE Twinbrook) Study Area and Monitoring Locations

The dominant noise sources to the Twinbrook (SE Twinbrook) study area are the CSX and Metro rail lines to the southwest, and Veirs Mill Road to the north. Twenty-four hour noise monitoring data were obtained at three locations in the study area: 1627 Lewis Avenue (on Lewis Avenue, not on the CSX / Metro Rail right-of-way fence), Twinbrook Park, and the intersection of Halpine Road and Lewis Avenue. Short-term noise monitoring data were obtained at four locations in the study area: the intersection of Veirs Mill Road and Okinawa Avenue, the intersection of St Lo Avenue and Okinawa Avenue, the intersection of Rockland Avenue and Matthews Drive, and the intersection of Rockland Avenue and Ridgeway Avenue.

Table 2.10 – Noise Monitoring Data: Twinbrook (SE Twinbrook)							
Location	**$L_{eq(h)}$**	**L_{max}**	**L_{10}**	**L_{90}**	**L_{dn}**	**L_{eq24h}**	**Comment**
1. 1627 Lewis Avenue	64	90	69	56	65	61	24-hour
2. Twinbrook Park	58	74	59	57	63	56	24-hour
3. Halpine & Lewis	83	115	83	71	80	75	24-hour
4. Veirs Mill & Okinawa	77*	85	81*	70*	N/A	N/A	Short-term
5. St Lo & Okinawa	53*	56	54*	52*	N/A	N/A	Short-term
6. Rockland & Matthews	53**	68	56**	50**	N/A	N/A	Short-term
7. Rockland & Ridgeway	52**	67	55**	50**	N/A	N/A	Short-term
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.							
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Veirs Mill Road and Okinawa Avenue.*							
***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 1627 Lewis Avenue.*							

Noise monitoring data obtained at the properties adjacent to the CSX / Metro Rail lines indicates that these properties are severely impacted, with a loudest-hour equivalent sound level, $L_{eq(h)}$ = 83dBA, significantly above the 66dBA noise impact criterion. Noise monitoring data obtained at the properties adjacent to the eastbound lanes of Veirs Mill Road are also severely impacted, with a loudest-hour equivalent sound level, $L_{eq(h)}$ = 77dBA. There is no statistical correlation between 24-hour monitoring data obtained at the intersection of Veirs Mill Road and Okinawa Avenue and the intersection of Halpine Road and Lewis Avenue (ρ_{Leq} = -0.1, ρ_{Lmax} = -0.1, ρ_{L10} = -0.2, ρ_{L90} = 0.3), indicating that the two dominant noise sources are unrelated, and create noise impacts to the study area independently of each other. Furthermore, it is notable that although the properties on the odd side of Lewis Avenue are severely impacted where adjacent to CSX / Metro Rail, the properties on the even side of Lewis Avenue are not. The rail transit noise impacts along the odd-numbered Lewis Avenue residences adjacent to the CSX / Metro Rail lines experience greater noise annoyance due to the periodic passage of trains over the rail lines than do the impacted residences along Veirs Mill Road that are exposed to constant automobile/truck traffic noise.

Noise monitoring data obtained throughout the study area identified noise impacts along Veirs Mill Road, and to the odd-numbered homes along Lewis Avenue.

2.11 Watts Branch Parkway – Rose Hill Development (Fallswood, Rockshire, Rose Hill, Rose Hill Falls, Saddlebrook)

The Watts Branch Parkway – Rose Hill Development (Rockshire, Fallswood, Saddlebrook, Rose Hill, Rose Hill Falls) study area consists of the eastern portions of the Rockshire, Fallswood, and Saddlebrook neighborhoods adjacent to the southbound lanes of Interstate 270, and the Rose Hill and Rose Hill Falls neighborhoods east of Interstate 270 and west of Great Falls Road, as shown in Figure 2.11: Watts Branch Parkway – Rose Hill Development (Rockshire, Fallswood, Saddlebrook, Rose Hill, Rose Hill Falls) Study Area and Monitoring Locations, below:

Figure 2.11: Watts Branch Parkway – Rose Hill Development (Fallswood, Rockshire, Rose Hill, Rose Hill Falls, Saddlebrook) Study Area and Monitoring Locations

The dominant noise source to the Watts Branch Parkway and Rose Hill Development Study areas is Interstate 270. Noise monitoring was completed in both study areas on the same day to assess the performance of the sound wall noise barrier protecting the residences adjacent to the southbound lanes of Interstate 270. Twenty-four hour noise monitoring data were obtained at three locations in the Watts Branch Parkway study area: 520 Watts Branch Parkway, the intersection of Loch Ness Court and Watts Branch Parkway, and 14 Ingleside Court at the lot-line nearest to Interstate 270. Short-term noise monitoring data were obtained at eighteen locations in the study area: 9 Grovepoint Court, 3 Grovepoint Court, Woodsend Place and Woodsend Court, Approximately 120 feet west of 520 Watts Branch Parkway (approximately twice the distance from Interstate I-270 as the first 24-hour receptor location), 428 Watts Branch Parkway, 3 Fallswood Court, the intersection of Fallswood Court and Watts Branch Parkway, 1418 Fallswood Drive, 1405 Fallswood Drive, the intersection of Winding Rose Drive and Winding Rose Drive, Approximately 200 feet east of Interstate 270 (approximately one-half the distance from Interstate 270 as the short-term receptor location at Winding Rose Drive and Winding Rose Drive), the intersection of Winding Rose Drive and Blue Hosta Way, 20 Blue Hosta Way, the tennis courts at Blaze Climber Circle, the intersection of Winding Rose Drive and Nocturne Court, the intersection of Rose Petal Way and Great Falls Road, and the intersection of Rose Petal Way and Autumn Wind Way.

Table 2.11 – Noise Monitoring Data: Watts Branch Parkway / Rose Hill Development (Fallswood, Rockshire, Rose Hill, Rose Hill Falls, Saddlebrook)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
1. 520 Watts Branch	66	78	66	65	68	63	24-hour. Impacted
2. Loch Ness & Watts Br	66	81	68	64	67	63	24-hour. Impacted
3. 14 Ingleside Ct	68	81	69	67	71	66	24-hour. Impacted
4. 9 Grovepoint Ct	56	62	56	55	N/A	N/A	Short-term. Not impacted
5. 3 Grovepoint Ct	54	68	55	54	N/A	N/A	Short-term. Not impacted
6. 9 Woodsend Pl	62*	67	62*	61*	N/A	N/A	Short-term. Not impacted
7. Woodsend Pl & Ct	61*	54	61*	60*	N/A	N/A	Short-term. Not impacted
8. 120' W of 520 Watts B	65	69	66	64	N/A	N/A	Short-term. Not impacted
9. 428 Watts Branch	68	71	68	67	N/A	N/A	Short-term. Impacted
10. 3 Fallswood Ct	61	76	61	59	N/A	N/A	Short-term. Not impacted
11. Fallswood Ct & WB	67	71	68	66	N/A	N/A	Short-term. Impacted
12. 1418 Fallswood Dr	55*	64	57*	53*	N/A	N/A	Short-term. Not impacted
13. 1405 Fallswood Dr	59*	68	61*	57*	N/A	N/A	Short-term. Not impacted
14. Winding Rose	65*	69	67*	65*	N/A	N/A	Short-term. Not impacted
15. 200' E of I-270	68*	76	68*	65*	N/A	N/A	Short-term. Impacted
16. Winding Rose-Bl Hosta	69*	72	70*	67*	N/A	N/A	Short-term. Impacted
17. 20 Blue Hosta	63*	66	63*	62*	N/A	N/A	Short-term. Not impacted
18. Blaze Climber Tennis	64*	67	65*	63*	N/A	N/A	Short-term. Not impacted
19. Winding Rose-Nocturn	57*	74	63*	50*	N/A	N/A	Short-term. Not impacted
20. Rose Petal & Gr Falls	68	84	74	58	N/A	N/A	Short-term. Impacted
21. Rose Petal & Autmn W	53*	60	55*	47*	N/A	N/A	Short-term. Not impacted

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.

**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 520 Watts Branch Parkway.*

Noise monitoring data obtained at the properties adjacent to the southbound lanes of Interstate 270 indicate that although these properties are protected by a sound barrier noise wall, they are still impacted by Interstate 270 traffic noise, with a loudest-hour equivalent sound level, $L_{eq(h)}$ = 68dBA, above the 66dBA noise impact criterion. However, the data do not quantify the insertion losses attributable to the existing sound barrier noise wall. Without the sound barrier noise wall, the noise levels along Watts Branch Parkway would be significantly higher. Noise monitoring data obtained at the properties adjacent to the northbound lanes of Interstate 270 also indicate noise levels greater than 66dBA.

Noise monitoring data obtained throughout the study area identified noise impacts along Watts Branch Parkway, Ingleside Court, Marwood Court, and Great Falls Road.

3. Existing Noise Impacts

Transportation noise impacts a receptor if the transportation noise source projects sound energy such that the average sound level of the loudest hour of the day at the receptor exceeds 66 A-weighted decibels (66dBA). The noise monitoring data obtained in the City of Rockville, MD between Thursday, September 23, 2004 and Wednesday, November 03, 2004 identified several transportation noise sources that create noise impacts to residences. Table 3.1 is a compilation of transportation noise impacts that noise monitoring data identified within the study areas.

Table 3.1 City of Rockville Residential Noise Impacts

Study Area	Fig.	$L_{eq(h)}$*	Source	Impacts
North Stonestreet Avenue	3.7	84	CSX / Metro Rail	North Stonestreet Avenue, Frederick Avenue
Twinbrook (Rockshire Courts, NW Twinbrook)	3.8	83	CSX / Metro Rail	Lewis Avenue, Rockcrest Circle
		81	Veirs Mill Road	Veirs Mill Road, Gail Avenue, Wade Avenue, Edmonston Drive, and Claggett Drive
Twinbrook (SE Twinbrook)	3.9	83	CSX / Metro Rail	Lewis Avenue
		77	Veirs Mill Road	Veirs Mill Road, Coral Sea Drive, Abbott Road, Broadwood Drive, Okinawa Avenue, Ardennes Drive, and Midway Avenue
Glenora Hills	3.2	76	Darnestown Road	Darnestown Road, Glenora Lane near Darnestown Road
West End (Nelson Street)	3.3	76	Interstate 270	Nelson Street, Owens Court, Owens Street, Anderson Avenue, Beall Avenue
		66	West Montgomery Avenue	West Montgomery Avenue
North Farm	3.6	75	Montrose Road	Farm Haven Drive
Norbeck Road (Burgundy Knolls, East Rockville, Redgate Farms)	3.4	74	Norbeck Road	Norbeck Road, First Street, Redgate Farms Court, Allan Road, Robert Road, Baltimore Road, Reading Avenue, Maple Avenue and Grandin Avenue
Norbeck Road (Burgundy Estates, Silver Rock, NE Twinbrook)	3.5	73	Veirs Mill Road	Veirs Mill Road, Edmonston Drive, Broadwood Drive, Woodburn Road, Claggett Drive, Cedar Lane
		66	Norbeck Road	Denham Road, Denham Court, Baltimore Road, Maple Avenue, Grandin Avenue
		69	Twinbrook Parkway	McAuliffe Drive, Meadow Hall Drive, Roseanne Lane, Dorothy Lane, and Pinneburg Avenue
Watts Branch Parkway – Rose Hill Development (Fallswood, Rockshire, Rose Hill, Rose Hill Falls, Saddlebrook	3.10	69	Interstate 270	Watts Branch Parkway, Ingleside Court, Marwood Court, Chantilly Court, Blue Hosta Way
		68	Great Falls Road	Great Falls Road

**All measurements indicate the loudest whole hour equivalent sound levels, $L_{eq(h)}$, in A-weighted decibels, dBA*

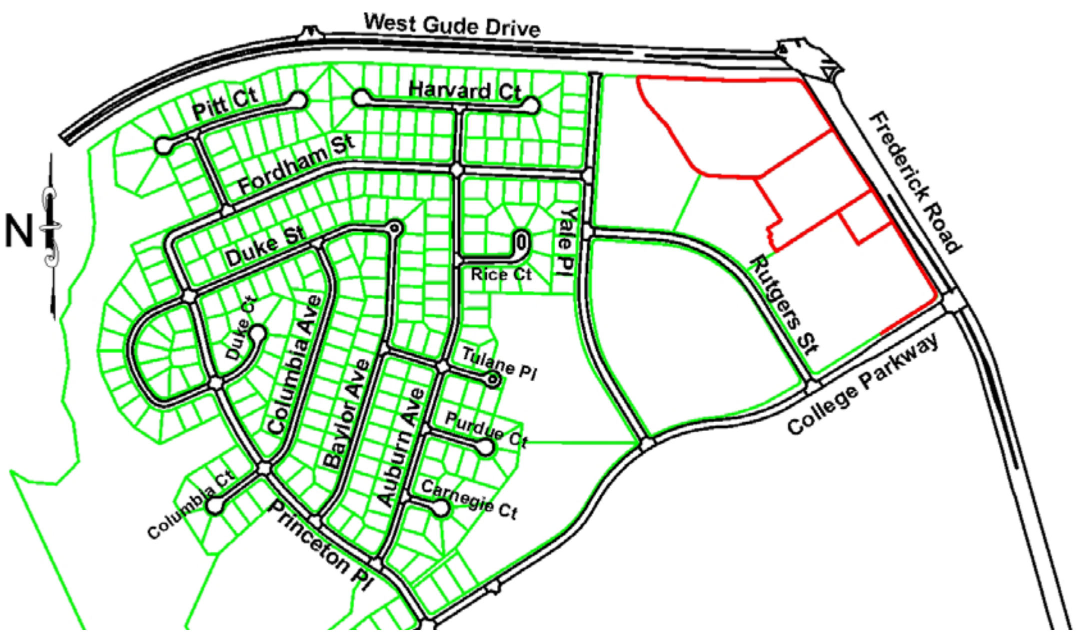
Sections 3.1 through 3.10 describe the noise impacts identified by the noise monitoring data. Sections 3.11 through 3.16 describe estimated transportation noise impacts throughout the areas within City limits in which noise monitoring data was not obtained as part of this study. The estimated transportation noise impacts are based upon comparing the neighborhoods described in sections 3.11 through 3.16 to locations within the noise monitoring study areas that have similar geographic and topographic relationships to common transportation facilities and/or traffic volumes. Further study will be required to accurately assess the exact number of transportation noise impacts to the neighborhoods described in sections 3.11 through 3.16.

3.1 College Gardens

The dominant noise source to the College Gardens study area is West Gude Drive; however, an earth berm noise barrier mitigates West Gude Drive traffic noise, effectively reducing loudest-hour equivalent noise levels, $L_{eq(h)}$, in the College Gardens study area below the 66dBA impact criterion threshold. Noise monitoring data obtained at the top of the earth berm noise barrier, at the base of the neighborhood side of the berm at Yale Street, and at the intersection of Yale Street and Fordham Street indicate that the noise level reduction from the earth berm is approximately 14dBA. College Parkway is a lesser source of transportation noise to the southern limits of the College Garden neighborhood and the Plymouth Woods neighborhood. Although the loudest-hour equivalent noise levels at the residential lot-lines along College Parkway are louder than at other residences within the study area, College Parkway traffic does not create noise impacts to these residences.

Figure 3.1: College Gardens Transportation Noise Impacts, below, shows the areas with estimated existing loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. Since none of the areas shown in red are residential properties, present consideration is that there are no existing transportation noise impacts to the College Gardens neighborhood.

Figure 3.1: College Gardens Transportation Noise Impacts

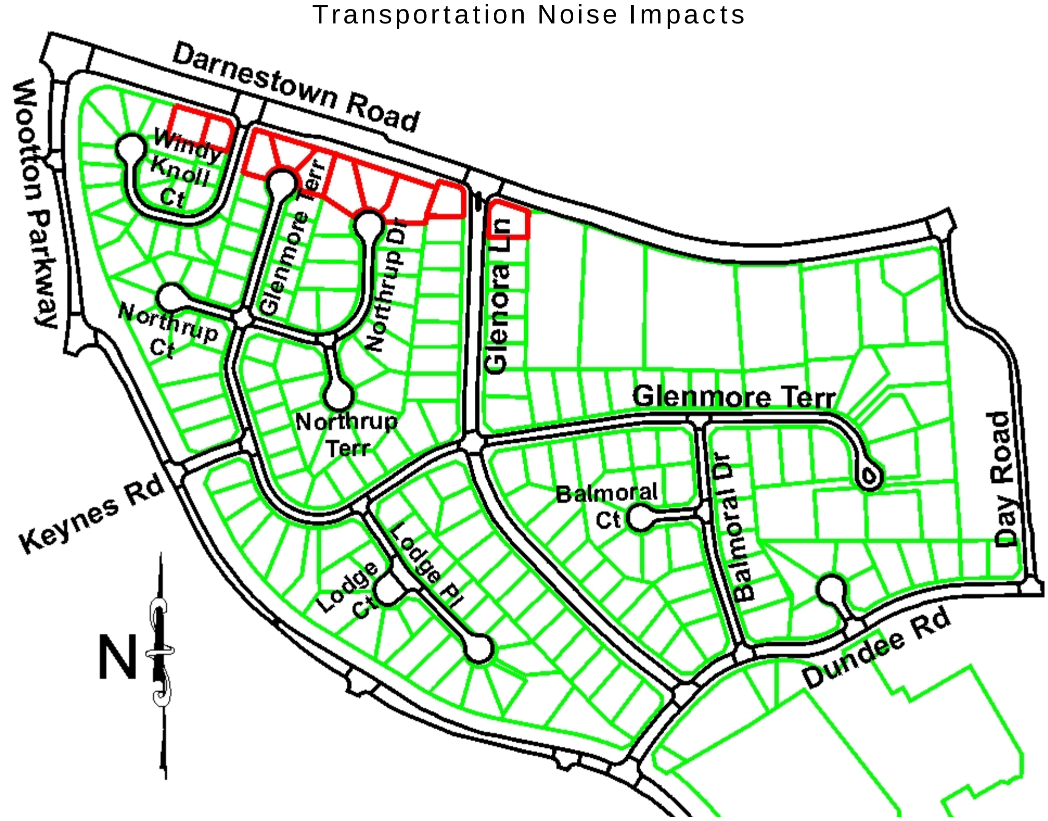


3.2 Glenora Hills (Glenora Hills, Griffith Oaks, Rockshire)

The dominant noise sources to the Glenora Hills (Glenora Hills, Griffith Oaks, Rockshire) study area are Wootton Parkway to the west and Darnestown Road to the north. An earth berm noise barrier protects residences adjacent to Wootton Parkway and in the southeast quadrant of the intersection of Darnestown Road and Wootton Parkway. However, Darnestown Road traffic noise impacts residences adjacent to Darnestown Road not protected by the earth berm sound barrier.

Figure 3.2: Glenora Hills (Glenora Hills, Griffith Oaks, Rockshire) Transportation Noise Impacts, below, shows the areas with monitored loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. The noise monitoring data identified ten residences (shown in red) along Darnestown Road that are impacted by traffic noise.

Figure 3.2: Glenora Hills (Glenora Hills, Griffith Oaks, Rockshire) Transportation Noise Impacts



3.3 West End (Nelson Street)

Interstate 270 traffic noise impacts residential properties on Nelson Street with measured loudest-hour equivalent sound levels, $L_{eq(h)}$, equal to 76dBA, as well as properties up to 400 feet east of Interstate 270, including the properties of Owens Court, with measured $L_{eq(h)}$ equal to 69dBA. Traffic noise impacts to residences on Nelson Street nearer to West Montgomery Road are lesser in magnitude due to the existing topography – the elevation of Nelson Street rises higher than the elevation of Interstate 270 as Nelson Street approaches West Montgomery Road. However, local traffic noise also impacts first-row residences adjacent to West Montgomery Road near the Interstate 270 interchange, with measured $L_{eq(h)}$ = 66dBA.

Figure 3.3: West End (Nelson Street) Transportation Noise Impacts, below, shows the areas with monitored loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. The noise monitoring data identified 36 residences (shown in red) in the West End neighborhood that are impacted by traffic noise.

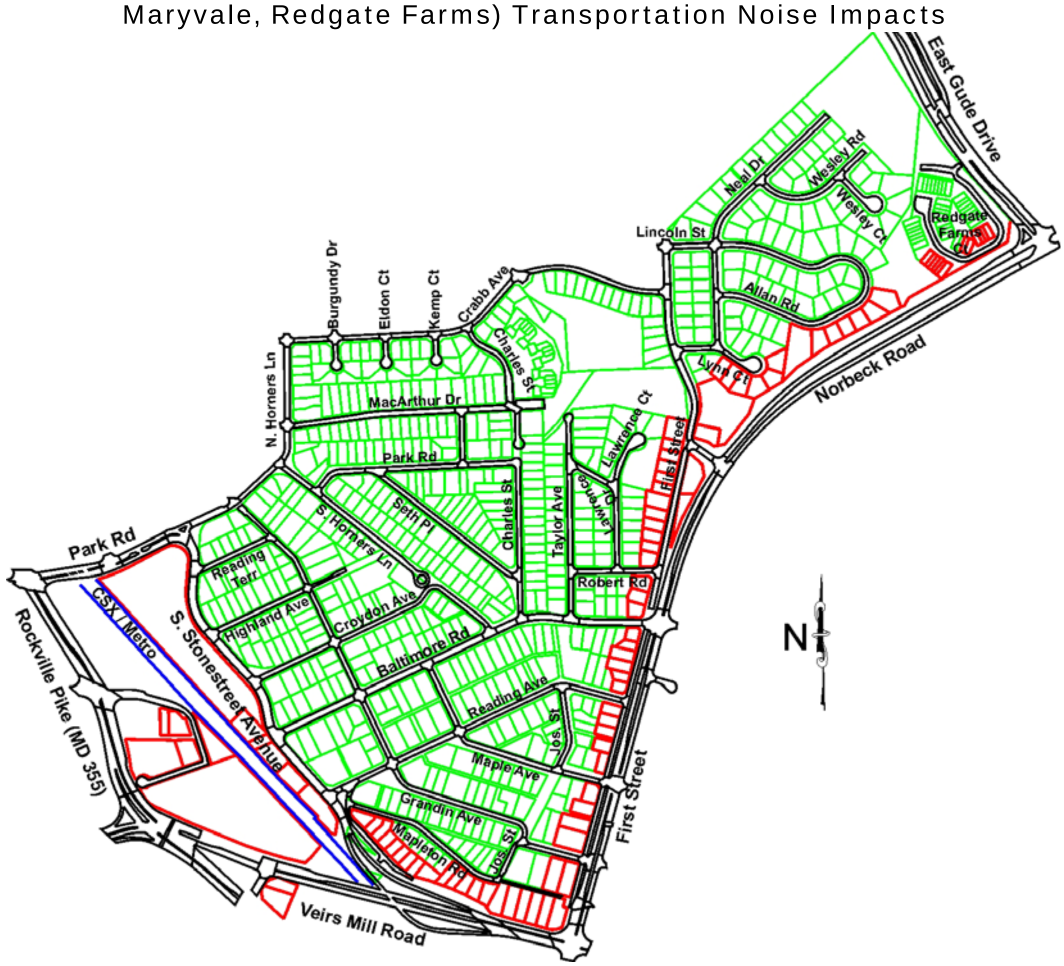
Figure 3.3: West End (Nelson Street) Transportation Noise Impacts

3.4 Norbeck Road (Burgundy Knolls, Charles Walk, East Rockville, Maryvale, Redgate Farms)

The Norbeck Road (Burgundy Knolls, Charles Walk, East Rockville, Maryvale, Redgate Farms) study and analysis area extends from East Gude Drive to the northeast, Norbeck Road / First Street to the south and southeast, Veirs Mill Road to the south, South Stonestreet Avenue to the southwest, and Park Road and Crabb Avenue to the north.

Figure 3.4: Norbeck Road (Burgundy Knolls, Charles Walk, East Rockville, Maryvale, Redgate Farms) Transportation Noise Impacts, below, shows the areas with monitored and estimated loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. Noise monitoring data identified Norbeck Road traffic noise impacts to the first- and second-row residences on Norbeck Road, First Street, Robert Road, Baltimore Road, Reading Avenue, Maple Avenue, and Grandin Avenue. Based upon noise monitoring data obtained at two locations along First Street, Norbeck Road traffic noise is estimated to impact six residences on Lynn Court, seven residences on Allan Road, and twelve residences on Redgate Farms Court. Based upon noise monitoring data obtained along Veirs Mill Road in the Twinbrook neighborhood, Veirs Mill Road traffic noise is estimated to impact eight residences on South Stonestreet Avenue and eleven residences on Mapleton Road.

Figure 3.4: Norbeck Road (Burgundy Knolls, Charles Walk, East Rockville, Maryvale, Redgate Farms) Transportation Noise Impacts

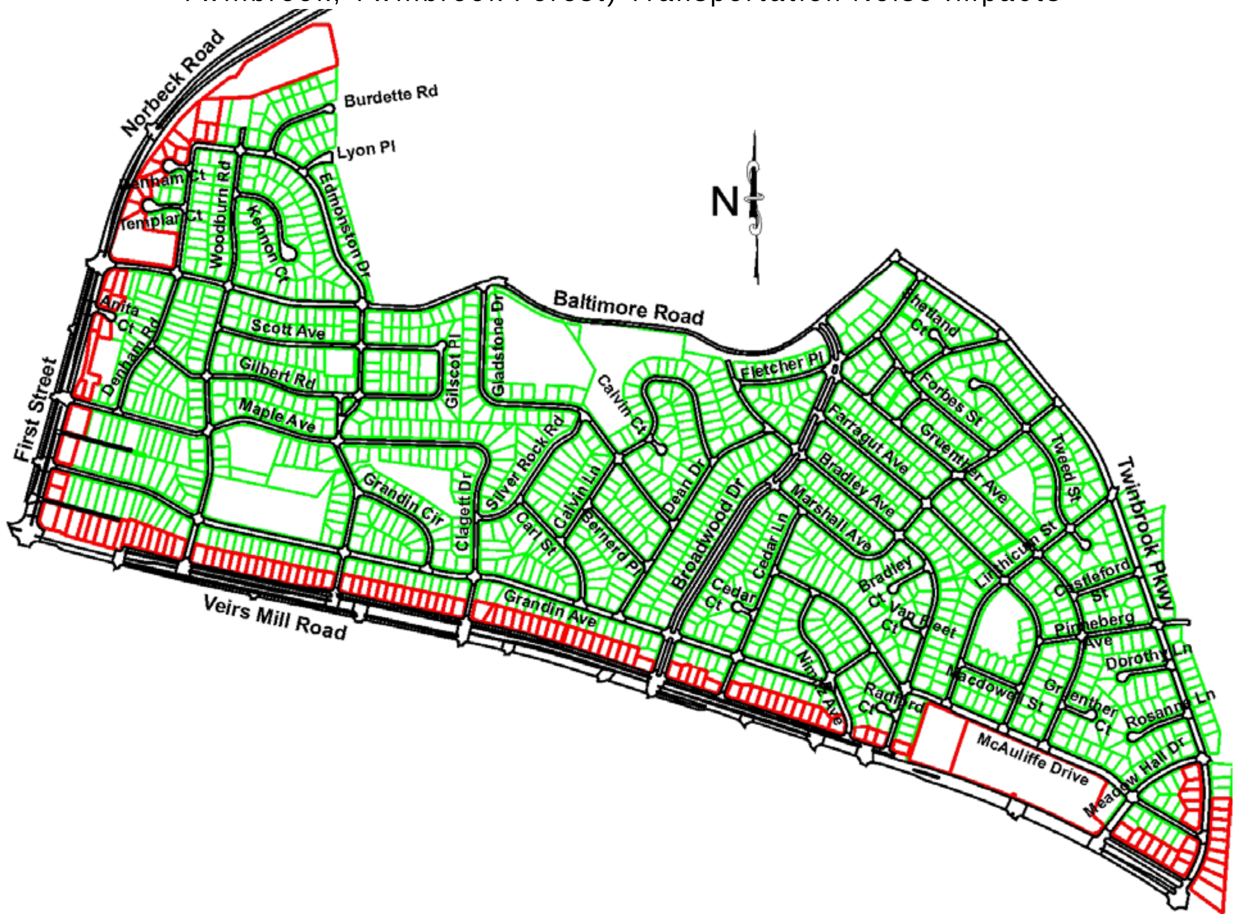


3.5 Norbeck Road and Veirs Mill Road (Burgundy Estates, Silver Rock, NE Twinbrook, Twinbrook Forest)

Norbeck Road and Veirs Mill Road are dominant noise sources to the western and southern limits of the Norbeck Road and Veirs Mill Road (Burgundy Estates, Silver Rock, NE Twinbrook, Twinbrook Forest) study area, respectively. Residences adjacent to Veirs Mill Road and Norbeck Road are impacted; however, second-row residences are not. Twinbrook Parkway traffic noise is a lesser source, but does create noise impacts with loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA for the residences adjacent to Twinbrook Parkway in the vicinity of Veirs Mill Road, McAuliffe Drive, and Meadow Hall Drive.

Figure 3.5: Norbeck Road and Veirs Mill Road (Burgundy Estates, Silver Rock, NE Twinbrook, Twinbrook Forest) Transportation Noise Impacts, below, shows the areas with monitored loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. Based on noise monitoring data obtained adjacent to Veirs Mill Road, at the intersection of McAuliffe Drive and Twinbrook Parkway, and adjacent to Norbeck Road, traffic noise impacts 93 residences along Veirs Mill Road, 15 residences along Twinbrook Parkway, and 24 residences adjacent to Norbeck Road / First Street.

Figure 3.5: Norbeck Road and Veirs Mill Road (Burgundy Estates, Silver Rock, NE Twinbrook, Twinbrook Forest) Transportation Noise Impacts

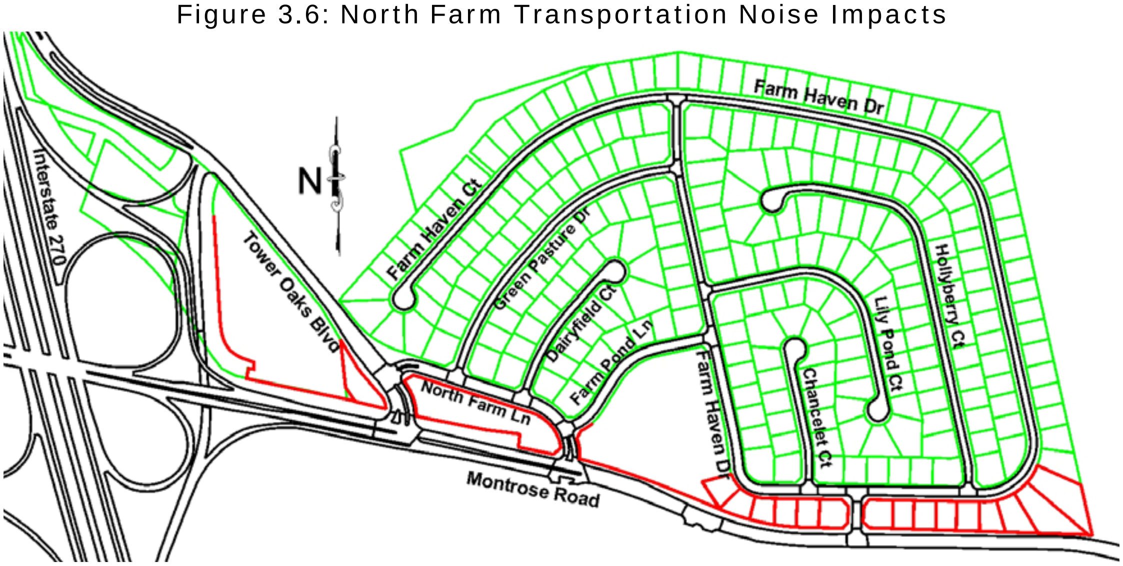


3.6 North Farm

The dominant noise source to the North Farm study area is Montrose Road, which presently impacts nine residences on Farm Haven Drive adjacent to Montrose Road. An earth berm sound barrier, approximately six feet in height, exists between the southern lot-lines of these impacted residences and Montrose Road. As part of the Montgomery County Department of Public Works and Transportation's Montrose Parkway West project (CIP #500311), a noise wall sound barrier will be constructed along part or all of the earth berm sound barrier horizontal alignment to mitigate the expected increase in Montrose Road traffic noise.

Figure 3.6: North Farm Transportation Noise Impacts, below, shows the areas with monitored loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. No analysis of Montgomery County's proposed noise wall sound barrier design or anticipated effectiveness was performed as part of this transportation noise study. Figure 3.6 does not represent predicted noise levels or transportation noise impacts that may exist after the proposed noise wall sound barrier is constructed between Montrose Road and the southern lot-lines of the impacted Farm Haven Drive residences.

Figure 3.6: North Farm Transportation Noise Impacts



3.7 North Stonestreet Avenue – Frederick Avenue (Lincoln Park)

The North Stonestreet Avenue – Frederick Avenue (Lincoln Park) study area is bounded by CSX / Metro rail to the west, Ashley Avenue to the north, Lincoln Avenue to the south, and Westmore Avenue and Douglas Avenue to the east. CSX / Metro rail transit noise impacts residences adjacent to the rail facility on the west side of North Stonestreet Avenue and throughout the 100-block of Frederick Avenue. Local traffic noise from within the study area and traffic noise from Hungerford Avenue (MD 355) is a lesser source and does not create any noise impacts to the study area.

Figure 3.7: North Stonestreet Avenue – Frederick Avenue (Lincoln Park) Transportation Noise Impacts, below, shows the areas with monitored loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. CSX / Metro rail transit noise impacts 24 residences along North Stonestreet Avenue and Frederick Avenue.

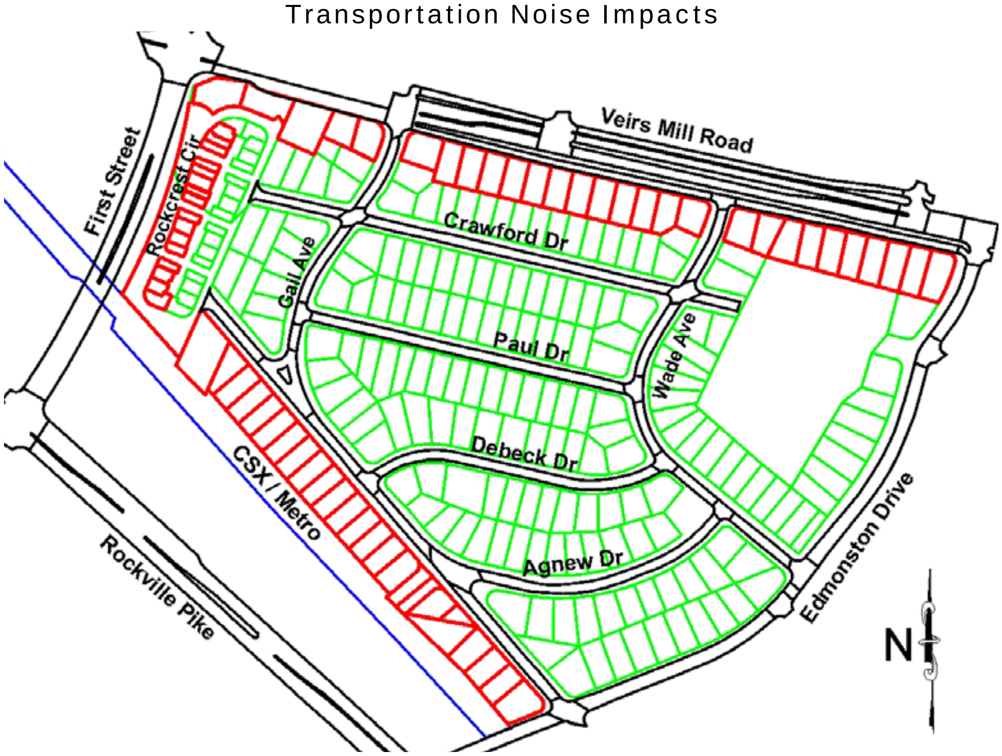
Figure 3.7: North Stonestreet Avenue – Frederick Avenue (Lincoln Park) Transportation Noise Impacts

3.8 Twinbrook (Rockcrest Courts, NW Twinbrook)

The Twinbrook (Rockcrest Courts, NW Twinbrook) study area extends from Veirs Mill Road to the north, First Street to the west, CSX / Metro rail to the southwest, and Edmonston Drive to the southeast. Veirs Mill Road traffic noise and CSX / Metro rail transit noise are the two dominant noise sources to the northern and southwestern borders of the study area, respectively. CSX / Metro rail transit noise impacts the odd-numbered residences of Lewis Avenue, whereas Veirs Mill Road traffic noise impacts the odd-numbered residences of Veirs Mill Road, as well as the residences on Gail Avenue, Wade Avenue, Edmonston Drive, and Claggett Drive that are nearest to Veirs Mill Road. The combination of First Street traffic noise, Veirs Mill Road traffic noise and CSX / Metro rail transit noise impacts the townhouse residences on Rockcrest Circle adjacent to First Street. Rockville Pike is not a significant noise source to the Twinbrook (Rockcrest Courts, NW Twinbrook) study area.

Figure 3.8: Twinbrook (Rockcrest Courts, NW Twinbrook) Transportation Noise Impacts, below, shows the residences within the study area that were monitored to have loudest-hour equivalent sound level, $L_{eq(h)}$, greater than or equal to 66dBA in red. Based upon noise monitoring data obtained adjacent to Veirs Mill Road, Veirs Mill Road traffic noise impacts 27 residences and one church south of Veirs Mill Road from First Street to Edmonston Drive. Based on noise monitoring data obtained adjacent to the CSX / Metro right-of-way, CSX / Metro rail transit noise impacts 25 residences between First Street and Edmonston Drive. Based on noise monitoring data obtained adjacent to First Street, traffic noise is estimated to impact 16 residences along Rockcrest Circle.

Figure 3.8: Twinbrook (Rockcrest Courts, NW Twinbrook) Transportation Noise Impacts

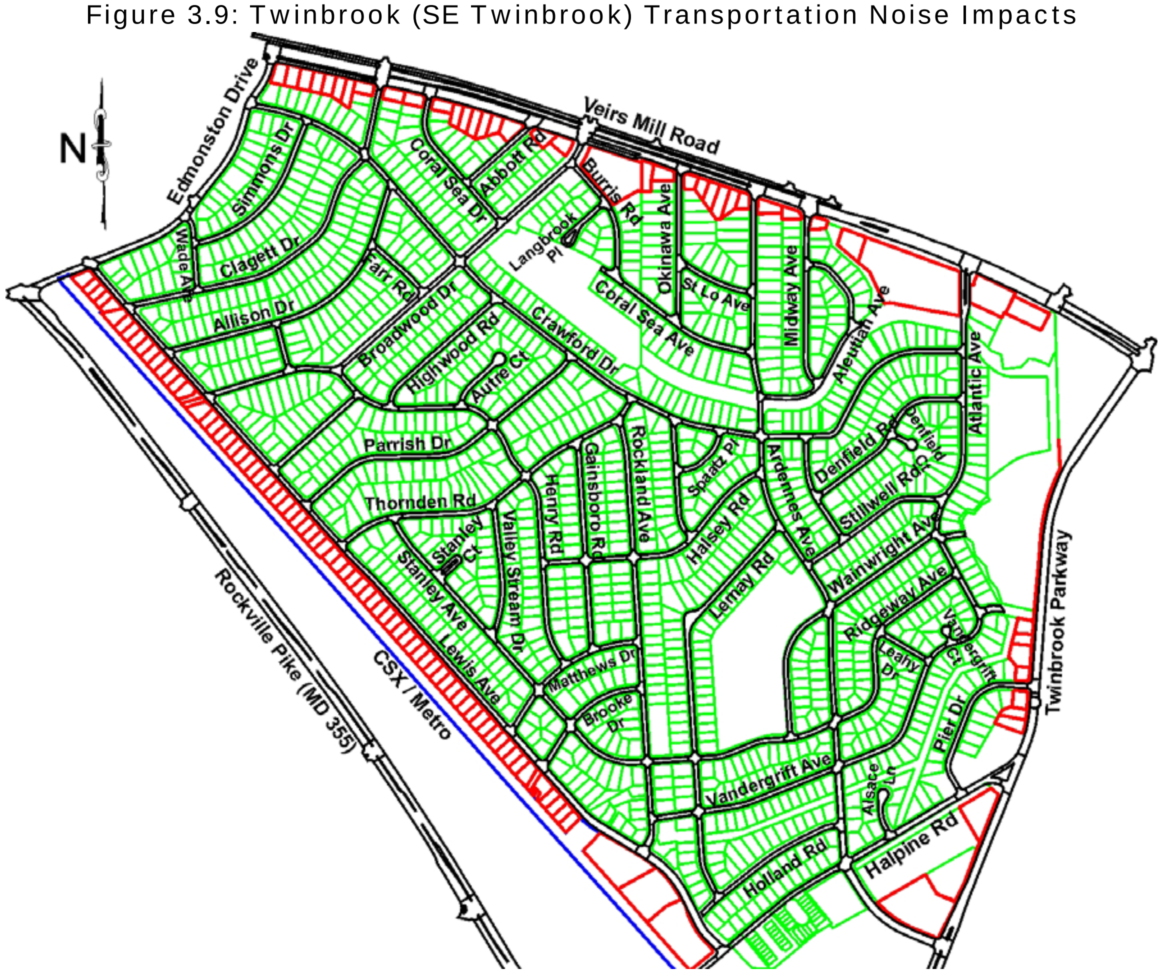


3.9 Twinbrook (SE Twinbrook)

The Twinbrook (SE Twinbrook) study area extends from Veirs Mill Road to the north, Twinbrook Parkway to the east, Halpine Road to the southeast, CSX / Metro rail to the southwest, and Edmonston Drive to the west. Veirs Mill Road traffic noise and CSX / Metro rail transit noise are the two dominant noise sources to the northern and southwestern borders of the study area, respectively. CSX / Metro rail transit noise impacts the odd-numbered residences of Lewis Avenue, whereas Veirs Mill Road traffic noise impacts the odd-numbered residences of Veirs Mill Road, as well as the residences on Coral Sea Drive, Abbott Road, Broadwood Drive, Okinawa Avenue, Ardennes Drive, and Midway Avenue that are nearest to Veirs Mill Road. Rockville Pike is not a significant noise source to the Twinbrook (SE Twinbrook) study area.

Figure 3.9: Twinbrook (SE Twinbrook) Transportation Noise Impacts, below, shows the residences within the study area that were monitored to have loudest-hour equivalent sound level, $L_{eq(h)}$, greater than or equal to 66dBA in red. Based upon noise monitoring data obtained adjacent to Veirs Mill Road, Veirs Mill Road traffic noise impacts 32 residences and one church south of Veirs Mill Road from Edmonston Drive to Midway Avenue. Based on noise monitoring data obtained adjacent to the CSX / Metro right-of-way, CSX / Metro rail transit noise impacts 71 residences between Edmonston Drive and Halpine Road.

Figure 3.9: Twinbrook (SE Twinbrook) Transportation Noise Impacts



3.10 Watts Branch Parkway – Rose Hill Development (Fallswood, Rockshire, Rose Hill, Rose Hill Falls, Saddlebrook)

Interstate 270 traffic is the dominant noise source to the Watts Branch Parkway and Rose Hill Development study area. A concrete sound wall noise barrier protects the even-numbered residences adjacent to Interstate 270 on the west side of Watts Branch Parkway, and an earth-berm sound barrier protects most of the residences in the Rose Hill Development from Interstate 270 traffic noise. The earth-berm sound barrier does not protect the residences near the intersection of Winding Rose Drive and Blue Hosta Way, where the loudest-hour equivalent sound level, $L_{eq(h)}$ = 69dBA. Local traffic noise from Great Falls Road creates noise impacts to the residences adjacent to Great Falls Road on both sides, with loudest-hour equivalent sound levels, $L_{eq(h)}$ = 68dBA.

Figure 3.10: Watts Branch Parkway – Rose Hill Development (Fallswood, Rockshire, Rose Hill, Rose Hill Falls, Saddlebrook) Transportation Noise Impacts, below, shows the residences within the study area that were monitored to have loudest-hour equivalent sound level, $L_{eq(h)}$, greater than or equal to 66dBA in red. Interstate 270 traffic noise impacts 73 residences along Watts Branch Parkway.

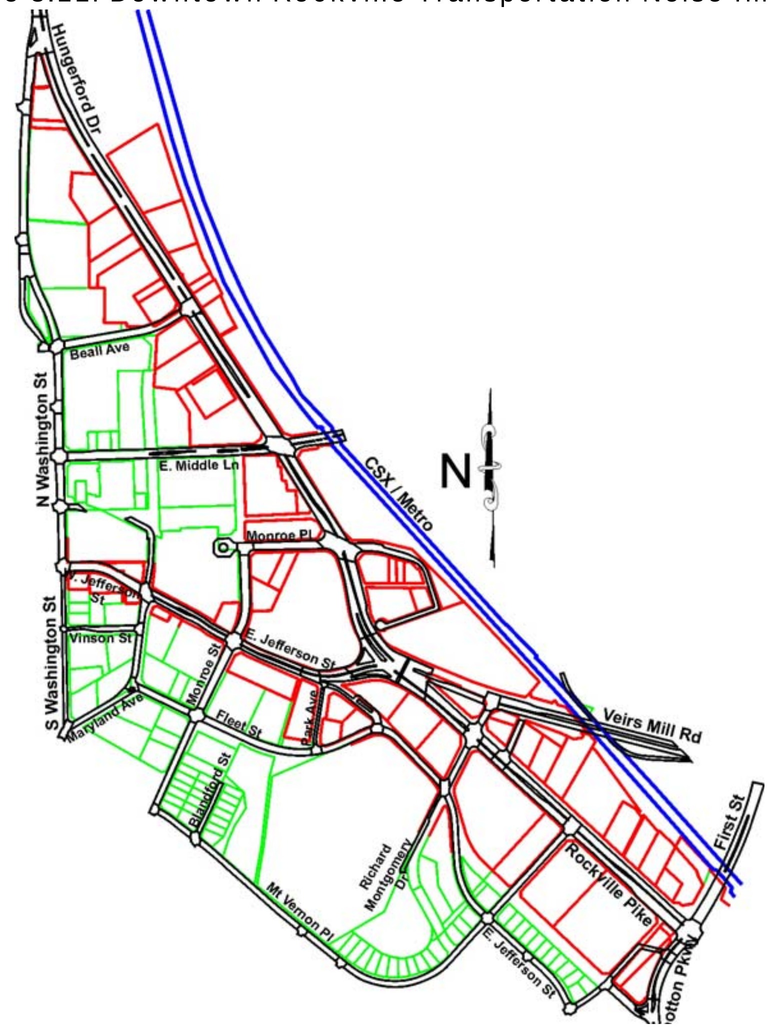
Figure 3.10: Watts Branch Parkway – Rose Hill Development (Fallswood, Rockshire, Rose Hill, Rose Hill Falls, Saddlebrook) Transportation Noise Impacts

3.11 Downtown Rockville (Americana Centre, Victoria)

The dominant transportation noise sources to downtown Rockville – east of Washington Street, southwest of the CSX / Metro rail lines, northeast of Mount Vernon Place, and northwest of Wootton Parkway – are CSX / Metro rail transit, Hungerford Road / Rockville Pike traffic, and downtown (local) traffic. The residential neighborhoods within this analysis area are Americana Centre and Victoria. Although sound level monitoring data were not obtained within this section of the City, sound levels can be estimated based upon sound level monitoring data obtained at locations with similar geographic and topographic relationships to CSX / Metro rail transit and Hungerford Road / Rockville Pike traffic.

Figure 3.11: Downtown Rockville Transportation Noise Impacts, below, shows the areas with estimated loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. Of these areas, only the ground level residences of the Americana Centre neighborhood meet the land-use criterion to be considered impacted by transportation noise. Americana Centre is located south of Monroe Place, north of East Jefferson Street, west of Rockville Pike, and east of Monroe Street. Further study is required to assess the exact number of transportation noise impacts to the 291 high-rise condominiums, 124 garden-style condominiums, and ten townhouse condominiums that meet transportation noise impact criterion.

Figure 3.11: Downtown Rockville Transportation Noise Impacts

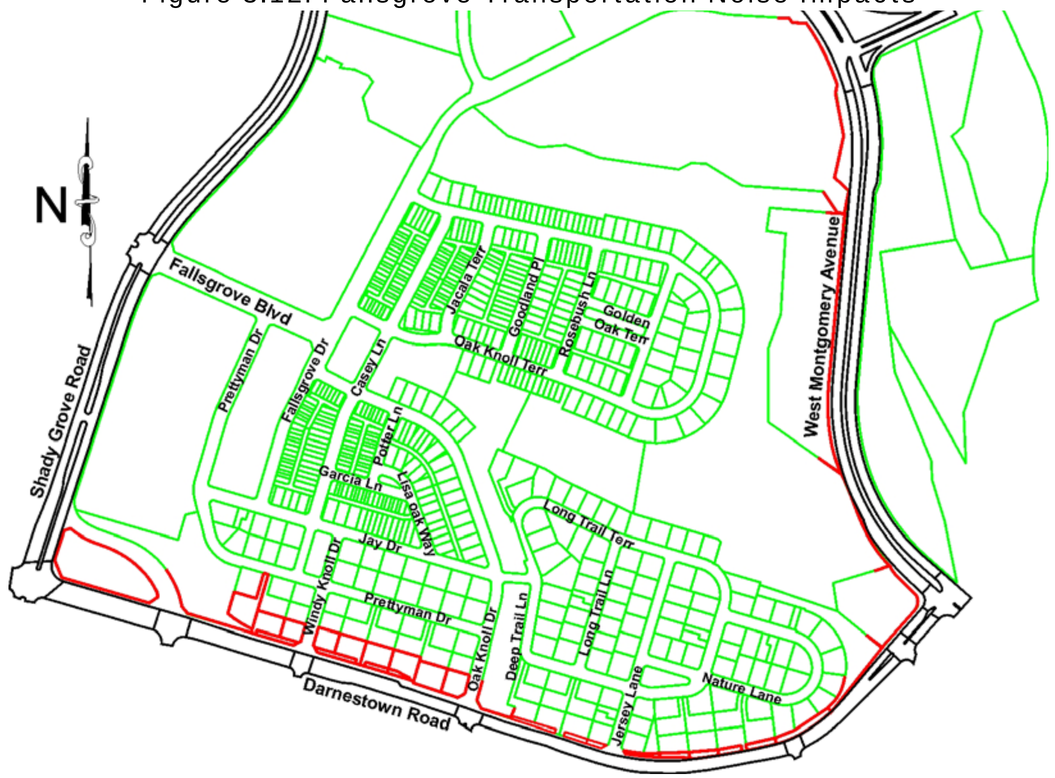


3.12 Fallsgrove

The dominant transportation noise source to the Fallsgrove neighborhood is Darnestown Road. Although sound level monitoring data were not obtained within the Fallsgrove neighborhood, sound levels can be estimated based upon sound level monitoring data obtained within the Glenora Hills neighborhood immediately south of Darnestown Road from the Fallsgrove neighborhood.

Figure 3.12: Fallsgrove Transportation Noise Impacts, below, shows the areas with estimated loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. Darnestown Road traffic noise is estimated to impact nine residences (shown in red) in the Fallsgrove neighborhood.

Figure 3.12: Fallsgrove Transportation Noise Impacts

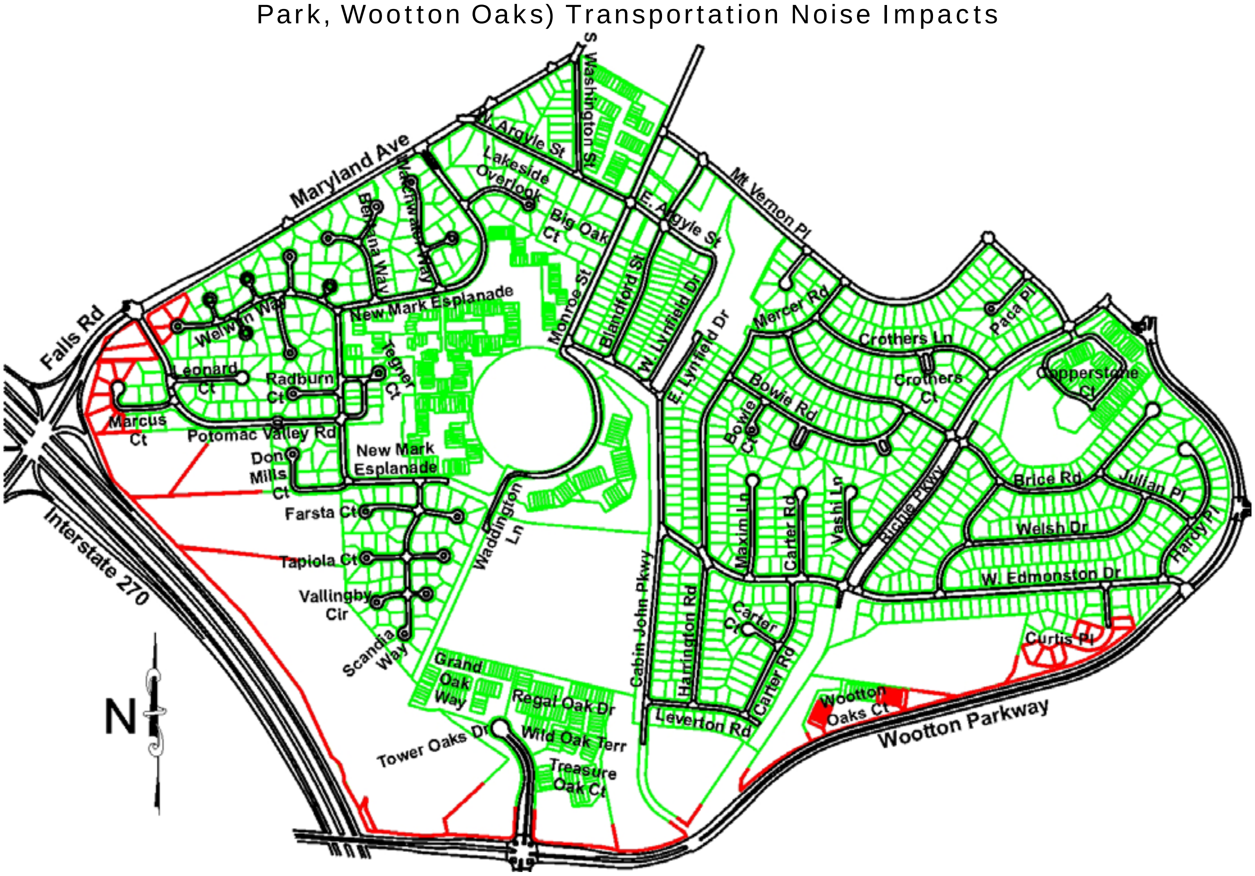


3.13 Hungerford (Courthouse Walk, Fireside, Hungerford, Jefferson Square, Lynfield, Markwood, New Mark Commons, The Villages at Tower Oaks, Waddington Park, Wootton Oaks)

The dominant noise sources to the Hungerford (Courthouse Walk, Fireside, Hungerford, Jefferson Square, Lynfield, Markwood, New Mark Commons, The Villages at Tower Oaks, Waddington Park, Wootton Oaks) analysis area are Wootton Parkway to the southeast and Interstate 270 to the southwest. A sound wall noise barrier protects residences on Hardy Place, Julian Place, Brice Road, and Copperstone Court from Wootton Parkway traffic noise.

Figure 3.13: Hungerford (Courthouse Walk, Fireside, Hungerford, Jefferson Square, Lynfield, Markwood, New Mark Commons, The Villages at Tower Oaks, Waddington Park, Wootton Oaks) Transportation Noise Impacts, below, shows the areas with estimated loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. Wootton Parkway traffic noise is estimated to impact thirteen residences on Wootton Oaks Court and six residences on Curtis Place. Further study is required to assess the number of impacted residences in the Markwood neighborhood adjacent to Interstate 270.

Figure 3.13: Hungerford (Courthouse Walk, Fireside, Hungerford, Jefferson Square, Lynfield, Markwood, New Mark Commons, The Villages at Tower Oaks, Waddington Park, Wootton Oaks) Transportation Noise Impacts

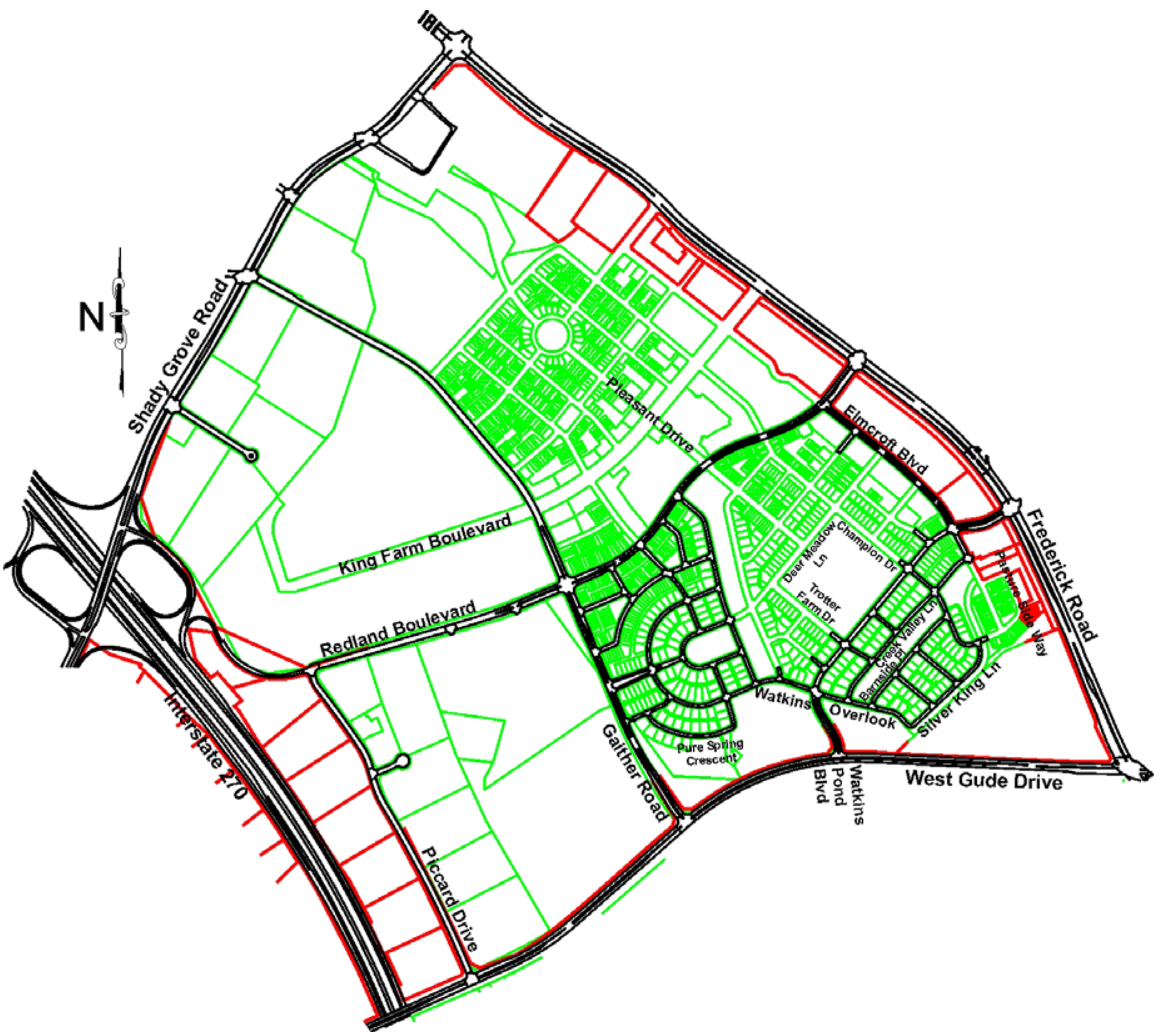


3.14 King Farm

Based upon the noise monitoring data obtained for the College Gardens neighborhood immediately south of West Gude Drive, West Gude Drive traffic noise does not create any transportation noise impacts to residential properties in the King Farm analysis area.

Figure 3.14: King Farm Transportation Noise Impacts, below, shows the areas with estimated loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. Frederick Road traffic noise is estimated to impact the residences along Pasture Side Way and Pasture Side Place that have direct exposure to (direct view of) Frederick Road; however, additional study is required to assess the exact number of these impacts.

Figure 3.14: King Farm Transportation Noise Impacts

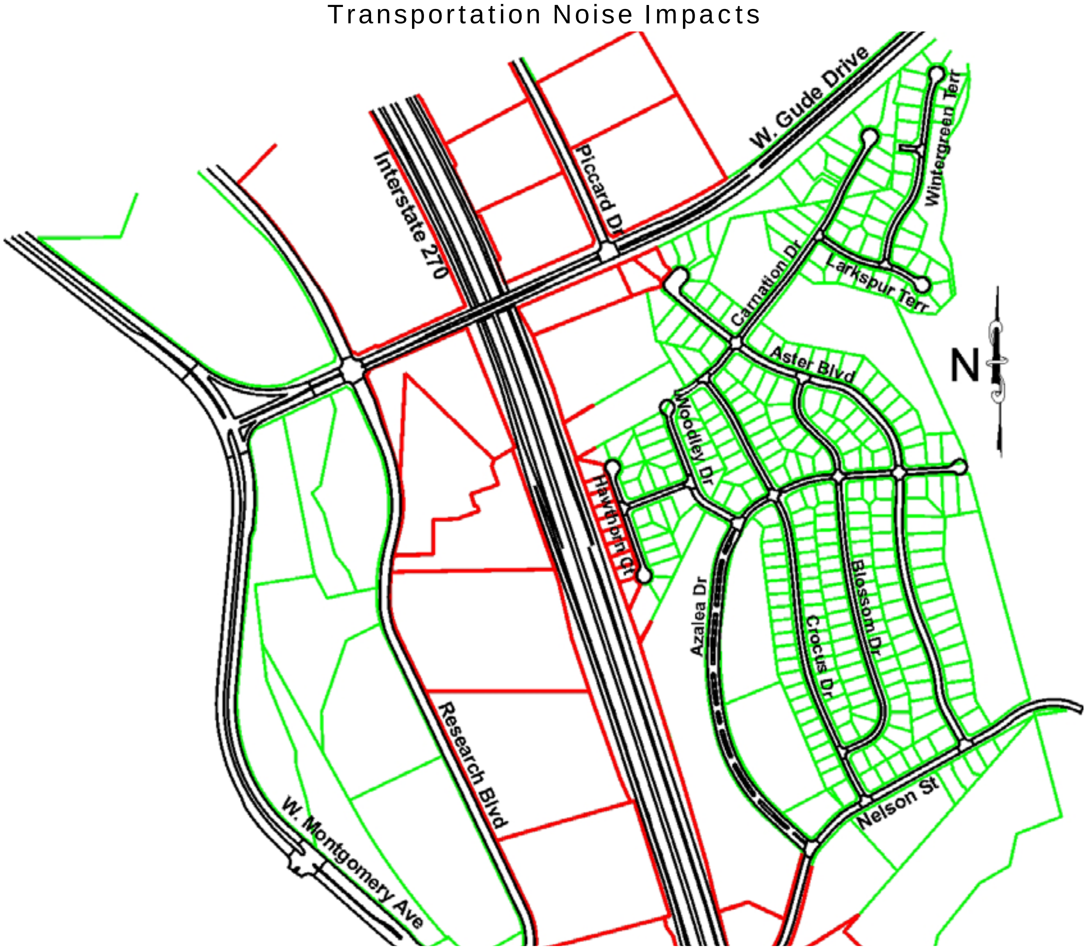


3.15 Regents Square – Woodley Gardens

The Regents Square – Woodley Gardens analysis area is bounded by West Gude Drive to the north, Interstate 270 to the west, Nelson Street to the south, and Upper Watts Branch Forest Preserve to the east. Interstate 270 and West Gude Drive are the dominant noise sources to the analysis area. An earth berm noise barrier mitigates traffic noise for the residences south of West Gude drive, and a noise wall sound barrier mitigates Interstate 270 traffic noise for the residences adjacent to Interstate 270 on Hawthorn Court and Azalea Drive.

Figure 3.15: Regents Square – Woodley Gardens Transportation Noise Impacts, below, shows the areas with estimated loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. Two residences at the north end of Aster Boulevard are fully exposed to West Gude Drive and based upon noise monitoring data obtained at the top of the berm in the College Gardens neighborhood are estimated to be impacted by traffic noise. Although the noise wall sound barrier along Interstate 270 is approximately twenty feet in height, the residences on Hawthorn Court and Azalea Drive are nevertheless estimated to have loudest-hour sound levels, $L_{eq(h)}$, greater than or equal to 66dBA. However, given its height, alignment, and the physical limits of transportation noise reduction, the noise wall sound barrier is considered to effectively mitigate Interstate 270 traffic noise for the analysis area.

Figure 3.15: Regents Square – Woodley Gardens
Transportation Noise Impacts

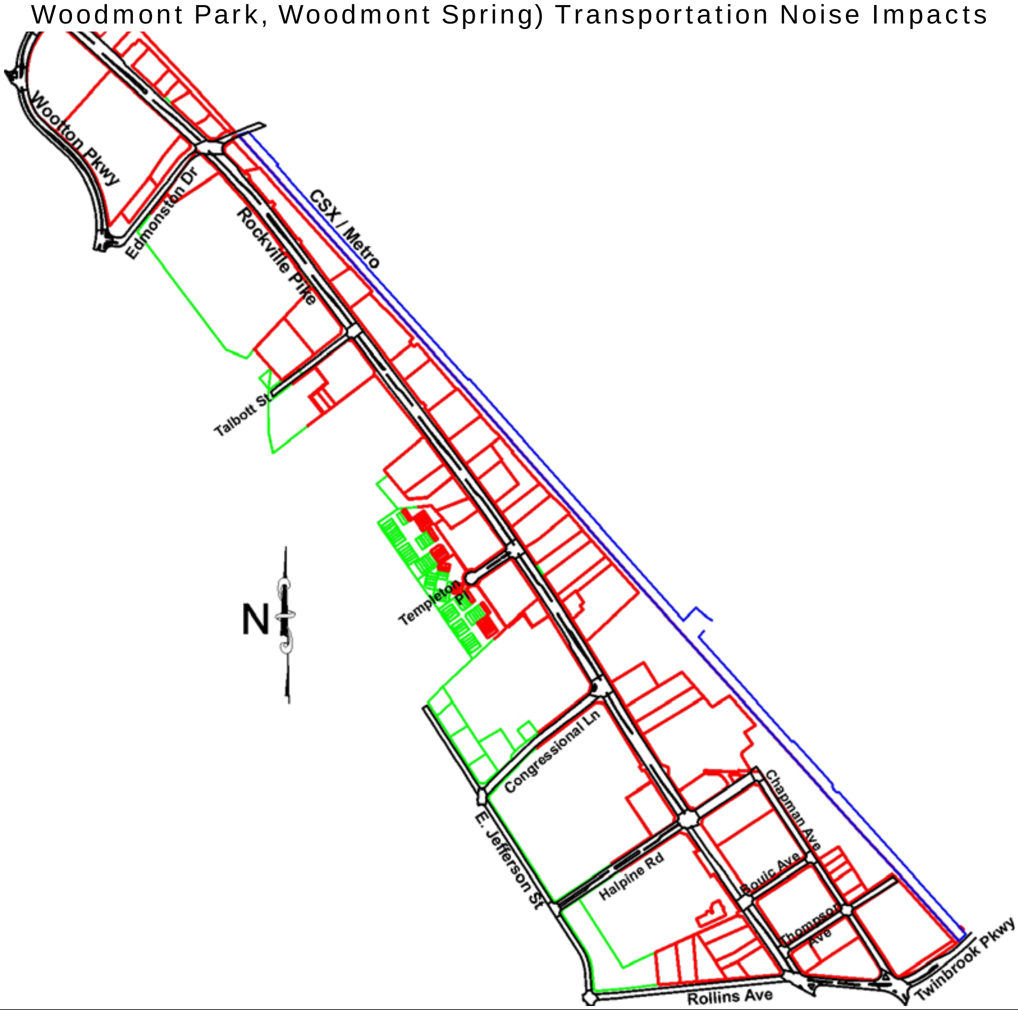


3.16 Rockville Pike (Village Green, Woodmont Overlook, Woodmont Park, Woodmont Spring)

The Rockville Pike (Village Green, Woodmont Overlook, Woodmont Park, Woodmont Spring) analysis area is bounded by CSX / Metro rail to the northeast, Wootton Parkway to the northwest, East Jefferson Street to the southwest, and Rollins Avenue to the southeast. Rockville Pike traffic and CSX / Metro rail transit are the dominant noise sources to the analysis area.

Figure 3.16 Rockville Pike (Village Green, Woodmont Overlook, Woodmont Park, Woodmont Spring) Transportation Noise Impacts, below, shows the areas with estimated loudest-hour equivalent sound levels, $L_{eq(h)}$, greater than or equal to 66dBA in red. The residences throughout the analysis area that are estimated to be impacted are those with an unobstructed (northeast) view of Rockville Pike. Further study is required to assess the exact number of impacted residences in the four residential neighborhoods within the analysis area.

Figure 3.16: Rockville Pike (Village Green, Woodmont Overlook, Woodmont Park, Woodmont Spring) Transportation Noise Impacts



4. Conclusion

4.1 Transportation Noise Environment in Rockville, MD

Transportation noise creates loudest-hour equivalent noise levels that are greater than or equal to the City's sixty-six decibel (66dBA) impact criterion to a significant number of residences throughout the City. These impacts vary in intensity, daily duration, and daily frequency. Many of the residences with loudest-hour sound levels equal to or greater than 66dBA are already protected by effective transportation noise mitigation systems such as noise wall sound barriers and earth berm sound barriers.

Most of the City's transportation noise impacts result from exposure to highway traffic noise; however, the CSX / Metro rail facility east of Rockville Pike / Hungerford Road also impacts adjacent residences. Table 4.1: Transportation Noise Impact Sources, below, lists the transportation facilities throughout the City of Rockville that create equivalent loudest-hour noise levels greater than or equal to 66dBA.

Table 4.1: Transportation Noise Impact Sources

Transportation Facility	**Impacted Neighborhood(s)**	**Comment**
CSX / Metro Rail	North Stonestreet Avenue (Lincoln Park) Rockcrest Courts, Twinbrook	Rail transit noise impacts 121 residences adjacent to the rail facility between Ashley Avenue and Halpine Road.
Darnestown Road	Fallsgrove, Glenora Hills, Griffith Oaks	Darnestown Road traffic noise impacts eighteen first-row residences between Wootton Parkway / Shady Grove Road and West Montgomery Avenue.
Great Falls Road	Rose Hill, Rose Hill Falls	Great Falls Road traffic noise impacts thirteen Rose Hill and Rose Hill Falls residences.
Gude Drive	Woodley Gardens	West Gude Drive traffic noise is estimated to impact two residences at the north end of Azalea Drive not protected by the earth berm sound barrier.
Hungerford Road / Rockville Pike (MD 355)	Americana Centre, Village Green, Woodmont Overlook, Woodmont Park, Woodmont Spring	The majority of residences exposed to Hungerford Road / Rockville Pike (MD 355) traffic noise do not meet transportation noise impact land-use criteria because they do not have ground-level floors. Further study would be required to assess the number of residences impacted by Hungerford Road / Rockville Pike (MD 355) traffic noise.
Interstate 270	Fallswood, New Mark Commons, Regents Square, Rockshire, Rose Hill, Rose Hill Falls, Saddlebrook, West End Park, Woodley Gardens	Sound barriers protect all impacted neighborhoods within City limits except West End Park. Interstate 270 traffic noise impacts thirty-three West End Park residences.
Montrose Road	North Farm	A noise wall sound barrier is to be constructed as part of Montgomery County's Montrose Parkway West project.
Norbeck Road / First Street	Burgundy Knolls, Burgundy Estates, Charles Walk, East Rockville, Maryvale, Redgate Farms, Rockshire Courts, Silver Rock	Norbeck Road / First Street traffic noise impacts eighty-four residences and one church between East Gude Drive and Veirs Mill Road.

Table 4.1: Transportation Noise Impact Sources		
Transportation Facility	**Impacted Neighborhood(s)**	**Comment**
Twinbrook Parkway	Twinbrook	Twinbrook Parkway traffic noise impacts sixteen residences along Twinbrook Parkway north of Veirs Mill Road.
Veirs Mill Road	East Rockville, Silver Rock, Twinbrook	Veirs Mill traffic noise impacts 168 residences and two churches between South Stonestreet Avenue and Twinbrook Parkway
Wootton Parkway	Hungerford, Wootton Oaks	Wootton Parkway traffic noise is estimated to impact eighteen residences on Wootton Oaks Court and Curtis Place.

4.2 Recommendations for Mitigation Analysis

The City's transportation noise impact sources were ranked based upon the number and density of impacted residences, the intensity of the measured and/or estimated loudest-hour equivalent sound levels, existing transportation noise mitigation systems, and a limited examination of the feasibility of implementing transportation noise mitigation measures.

Detailed noise analysis study and/or noise analysis mitigation study is not recommended for neighborhoods already protected by transportation noise mitigation systems, although resultant loudest-hour equivalent sound levels, $L_{eq(h)}$, at many benefited residences exceed the City's 66dBA transportation noise impact criterion. The existing transportation noise mitigation systems are considered to effectively reduce noise levels to within practical topographical, fiscal, aesthetic, and physical constraints. Further noise analysis of the Fallswood, Regents Square, Rockshire, Saddlebrook, Woodley Gardens, and College Gardens neighborhoods is not recommended. Noise analysis is not recommended for the North Farm neighborhood because Montrose Road transportation noise mitigation measures are to be implemented as part of Montgomery County's Montrose Parkway West Project.

Conversely, detailed noise analysis study and/or noise analysis mitigation analysis is recommended for impacted neighborhoods not protected by transportation noise mitigation systems, such as the Twinbrook, Lincoln Park, and West End neighborhoods. Table 4.2: Prioritized Recommendations for Mitigation Analysis, below, lists the recommended prioritization that should be given to future transportation noise studies within the City.

Table 4.2: Prioritized Recommendations for Mitigation Analysis

Transportation Facility	Transportation Impacts[4]	Comment
CSX / Metro Rail	121	Measured loudest hour equivalent sound levels exceed 80dBA for residences adjacent to the rail facility. Implementation of noise mitigation would greatly improve the quality of life at these residences. Detailed mitigation analysis is highly recommended.
Interstate 270	33	Measured loudest-hour equivalent sound levels exceed 70dBA for residences in the southwestern portion of the West End Park neighborhood. These are the only residences adjacent to Interstate 270 within City limits that are not protected by a sound barrier. Detailed mitigation analysis is highly recommended.
Norbeck Road / First Street	84(1)	Norbeck Road / First Street traffic noise impacts a high number of residences. Due to existing utilities and the near proximity of impacted residences to First Street, mitigating First Street traffic noise south of Baltimore Road is anticipated to be more costly than mitigating Norbeck Road traffic noise north of Baltimore Road. Detailed analysis is recommended to accurately assess the reasonableness and feasibility of mitigating Norbeck Road / First Street traffic noise.
Veirs Mill Road	168(2)	Veirs Mill Road traffic noise impacts a high number of residences. Mitigating Veirs Mill traffic noise may not be feasible due to existing utilities and near proximity of impacted residences to the highway itself. Detailed analysis is recommended to accurately assess the reasonableness and feasibility of mitigating Veirs Mill Road traffic noise.

[4] Churches are typically counted as ten "equivalent residences". However, in Table 4.2 the number of churches measured and/or estimated to be impacted by transportation noise is shown in parentheses, pending the City's adoption of a transportation noise policy.

Table 4.2: Prioritized Recommendations for Mitigation Analysis

Transportation Facility	**Transportation Impacts**[4]	**Comment**
Hungerford Road / Rockville Pike (MD 355)	Unknown	Loudest-hour equivalent sound levels are estimated to meet or exceed 66dBA at many residences. However, a majority of these will not meet noise impact criteria because they are not ground-level residences. Noise mitigation for the impacted residences that do qualify is unlikely to meet typical feasibility and reasonableness guidelines. Detailed noise analysis is not presently recommended.
Wootton Parkway	18	Only one of the eighteen residences estimated to have loudest-hour equivalent sound levels equal to or greater than 66dBA along Wootton Parkway pre-dates the highway. Further noise analysis is not recommended.
Twinbrook Parkway	16	Loudest-hour equivalent sound levels were measured to meet or exceed 66dBA at sixteen residences. Mitigating Twinbrook Parkway traffic noise may not be feasible due to existing utilities and near proximity of impacted residences to the highway itself. Detailed analysis is recommended to accurately assess the reasonableness and feasibility of mitigating Twinbrook Parkway traffic noise only as part of a Veirs Mill Road traffic noise study.
Darnestown Road	18	Loudest-hour equivalent sound levels approach 70dBA for the eighteen impacted residences north and south of Darnestown Road. However, a temporary but dramatic increase in construction traffic over the highway is believed to be the cause of these transportation noise impacts. Detailed analysis of Darnestown Road traffic noise is only recommended if the construction traffic volume is expected to be permanent or if noise levels persist beyond the duration of the presently active construction projects. Classified traffic counts of Darnestown Road traffic noise are recommended to better assess whether construction vehicles are the cause of Darnestown Road traffic noise impacts.
Great Falls Road	13	Measured loudest-hour equivalent sound levels reach 66dBA for thirteen residences along the northwest side of Great Falls Road, all of which post-date the roadway. No further analysis is recommended for Great Falls Road traffic noise.
Gude Drive	2	The earth-berm sound barrier along the south side of West Gude Drive effectively mitigates traffic noise for all but two residences that border the highway. No mitigation analysis is recommended for West Gude Drive traffic noise.
Montrose Road	18	No mitigation analysis is presently recommended because a noise wall sound barrier is to be constructed as part of Montgomery County's Montrose Parkway West project.

4.3 Recommendations for City of Rockville Transportation Noise Control Regulatory Mechanisms

Evident by the desire and need for this study, transportation noise is a growing concern for the City of Rockville, as it is a growing concern for many municipalities throughout the country. The City's noise environment is typical of many developing urban centers, in that local highway and rail transit noise are the dominant noise sources to commercial and residential areas.

In recognizing the City's need to address transportation noise, the following recommendations are made for proactive and reactive noise control mechanisms:

Transportation Noise Complaint Response Procedure:
Residents may file transportation noise complaints online via the City's "Citizen Service Request" form at www.rockvillemd.gov/residents/traffic/requestform.html or via e-mail totransportation@rockvillemd.gov. It is recommended that the City implement a response procedure by which a pre-determined number of complaints regarding a given transportation noise source results in a preliminary noise monitoring analysis. The preliminary noise monitoring analysis would consist of several sets of short-term noise monitoring data and classified traffic counts presented in a short memorandum of analysis.

Proactive Transportation Noise Analysis Mechanisms:
Ambient noise monitoring data should be obtained throughout residential neighborhoods adjacent to future transportation facility expansion and/or realignment projects prior to project initiation.[5] Ambient data will serve as the baseline for comparison to any noise monitoring data obtained after project completion. The noise monitoring data would be summarized in a short memorandum of analysis.

Computer modeling of predicted noise levels should be performed for all transportation facility expansion, realignment, and new projects as part of the design process. Computer modeling during the design process will identify new transportation noise impacts, and if necessary, allow for implementation of effective and reasonable noise mitigation systems.

It is recommended that City-wide transportation noise monitoring be performed at least once every five years to update the City's ambient noise data set and to address transportation noise concerns that arise during interim years.

Comprehensive Transportation Noise Policy:
The City of Rockville should adopt a Comprehensive Transportation Noise Policy that specifies transportation noise monitoring procedures, determination of eligible properties and/or land-use guidelines, noise monitoring data and analysis reporting procedures, transportation noise mitigation analysis reasonableness and feasibility criteria, transportation noise mitigation system design guidelines, and noise abatement requirements for new (residential) construction. The City's Transportation Noise Policy should concur with State of Maryland or Federal Highway Administration policy; however, it should also distinctly address the specific needs resulting from the City's urban noise environment.

[5] The data obtained as part of this noise analysis study will suffice for the study areas described herein.

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CITY OF ROCKVILLE

TRANSPORTATION NOISE STUDY
FINAL REPORT – APPENDIX A:
NOISE MONITORING DATA

April 15, 2005

<u>*Prepared for*</u>

City of Rockville, Maryland

<u>*Prepared by*</u>

Rummel, Klepper & Kahl, LLP

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A.1 Carter Road & Leverton Road (Hungerford)

Table A.1a – Noise Monitoring Data Summary (dBA): Carter Road & Leverton Road (Hungerford)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
Carter & Leverton	59	79	61	56	60	55	24-hr farthest from Wootton Pkwy
811 Leverton	59	74	61	57	61	56	24-hr
100’ S of Leverton	60	73	62	57	62	57	24-hr at nearest lot-line to source
801 Leverton*	54*	67	60*	52*	N/A	N/A	Short-term
807 Leverton*	55*	70	58*	52*	N/A	N/A	Short-term
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.							
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Carter & Leverton*							

Table A.1b – Noise Monitoring Data (dBA): Carter Road & Leverton Road

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
13:00	1:00:00	57	76	60	54	
14:00	1:00:00	54	70	57	51	
15:00	1:00:00	54	77	57	50	
16:00	1:00:00	54	78	56	50	
17:00	1:00:00	55	78	56	51	
18:00	1:00:00	55	71	58	53	
19:00	1:00:00	55	64	56	53	
20:00	1:00:00	55	65	56	53	
21:00	1:00:00	54	63	55	52	
22:00	1:00:00	54	60	55	53	
23:00	1:00:00	54	70	55	52	
0:00	1:00:00	50	56	52	49	
1:00	1:00:00	51	60	53	49	
2:00	1:00:00	51	61	53	49	
3:00	1:00:00	52	59	54	50	
4:00	1:00:00	53	60	55	52	
5:00	1:00:00	56	68	57	54	
6:00	1:00:00	57	71	58	55	
7:00	1:00:00	57	67	59	56	
8:00	1:00:00	59	76	61	55	Loudest-hour $L_{eq(h)}$
9:00	1:00:00	54	65	56	51	
10:00	1:00:00	53	71	57	49	
11:00	1:00:00	56	77	60	49	
12:00	1:00:00	56	79	60	49	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.1c – Noise Monitoring Data (dBA): 811 Leverton Road

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
13:00	1:00:00	59	72	61	54	
14:00	1:00:00	57	67	59	54	
15:00	1:00:00	57	70	59	55	
16:00	1:00:00	57	69	59	55	
17:00	1:00:00	57	67	59	55	
18:00	1:00:00	57	65	59	54	
19:00	1:00:00	57	68	59	54	
20:00	1:00:00	57	66	58	52	

Table A.1c – Noise Monitoring Data (dBA): 811 Leverton Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
21:00	1:00:00	56	64	57	49	
22:00	1:00:00	55	62	56	50	
23:00	1:00:00	54	73	56	49	
0:00	1:00:00	51	58	53	50	
1:00	1:00:00	52	58	53	52	
2:00	1:00:00	51	64	53	54	
3:00	1:00:00	52	64	54	55	
4:00	1:00:00	53	62	55	57	
5:00	1:00:00	56	63	57	56	
6:00	1:00:00	57	70	59	53	
7:00	1:00:00	59	68	61	51	Loudest-hour $L_{eq(h)}$
8:00	1:00:00	59	68	61	52	Loudest-hour $L_{eq(h)}$
9:00	1:00:00	57	68	60	52	
10:00	1:00:00	57	69	60	54	
11:00	1:00:00	56	71	59	54	
12:00	1:00:00	56	74	59	55	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.1d – Noise Monitoring Data (dBA): 100' South of Leverton Road Terminus						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:00	1:00:00	58	68	61	54	
14:00	1:00:00	57	69	60	53	
15:00	1:00:00	58	71	60	54	
16:00	1:00:00	57	67	59	54	
17:00	1:00:00	57	66	59	55	
18:00	1:00:00	58	67	60	55	
19:00	1:00:00	58	68	60	56	
20:00	1:00:00	58	65	59	56	
21:00	1:00:00	57	62	58	55	
22:00	1:00:00	56	63	58	55	
23:00	1:00:00	56	73	58	54	
0:00	1:00:00	53	60	54	51	
1:00	1:00:00	54	61	56	52	
2:00	1:00:00	53	66	55	51	
3:00	1:00:00	54	67	56	52	
4:00	1:00:00	55	62	56	54	
5:00	1:00:00	57	65	59	56	
6:00	1:00:00	58	67	60	56	
7:00	1:00:00	60	71	62	57	Loudest-hour $L_{eq(h)}$
8:00	1:00:00	59	69	62	57	
9:00	1:00:00	58	68	61	54	
10:00	1:00:00	57	70	61	52	
11:00	1:00:00	57	68	60	52	
12:00	1:00:00	57	69	60	52	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.1e – Noise Monitoring Data (dBA): 801 Leverton Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:30:00	0:01:00	59.2	66.7	62	56	

Table A.1e – Noise Monitoring Data (dBA): 801 Leverton Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:31:00	0:01:00	62.5	81.5	66	48	Despiked – statistical outlier
12:32:00	0:01:00	48.1	56.5	48	48	
12:33:00	0:01:00	50	59.5	54	48	
12:34:00	0:01:00	48	50.3	50	48	
12:35:00	0:01:00	48.4	50.6	50	48	
12:36:00	0:01:00	48.4	51.3	50	46	
12:37:00	0:01:00	50.5	57	54	46	
12:38:00	0:01:00	49.3	55	52	48	
12:39:00	0:01:00	48.6	49.8	50	48	
12:40:00	0:01:00	48.9	53.3	50	48	
12:41:00	0:01:00	48	49.1	48	48	
12:42:00	0:01:00	48.5	52.2	50	48	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.1f – Noise Monitoring Data (dBA): 807 Leverton Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:30:00	0:01:00	57.8	74.8	58	50	Despiked – statistical outlier
12:31:00	0:01:00	53.9	69.9	58	49	
12:32:00	0:01:00	50.3	54.7	51	49	
12:33:00	0:01:00	49.6	52.3	51	47	
12:34:00	0:01:00	50.3	52.2	51	48	
12:35:00	0:01:00	50.8	56.7	54	47	
12:36:00	0:01:00	51.6	55.8	54	47	
12:37:00	0:01:00	50.9	53.6	53	49	
12:38:00	0:01:00	50.8	53.1	52	48	
12:39:00	0:01:00	50.7	52.4	51	48	
12:40:00	0:01:00	50.4	52.9	52	49	
12:41:00	0:01:00	50.5	52.3	51	49	
12:42:00	0:01:00	50.7	55.1	52	49	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Figure A.1a: Diurnal $L_{eq(h)}$ Plot – Carter Road & Leverton Road Study Area

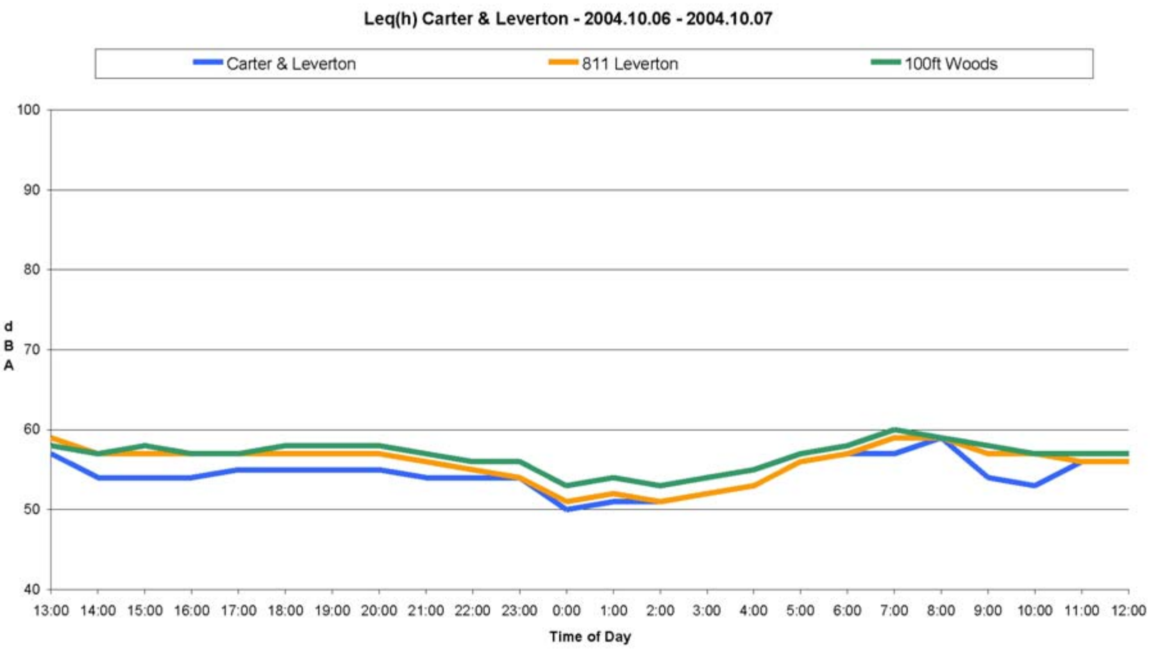
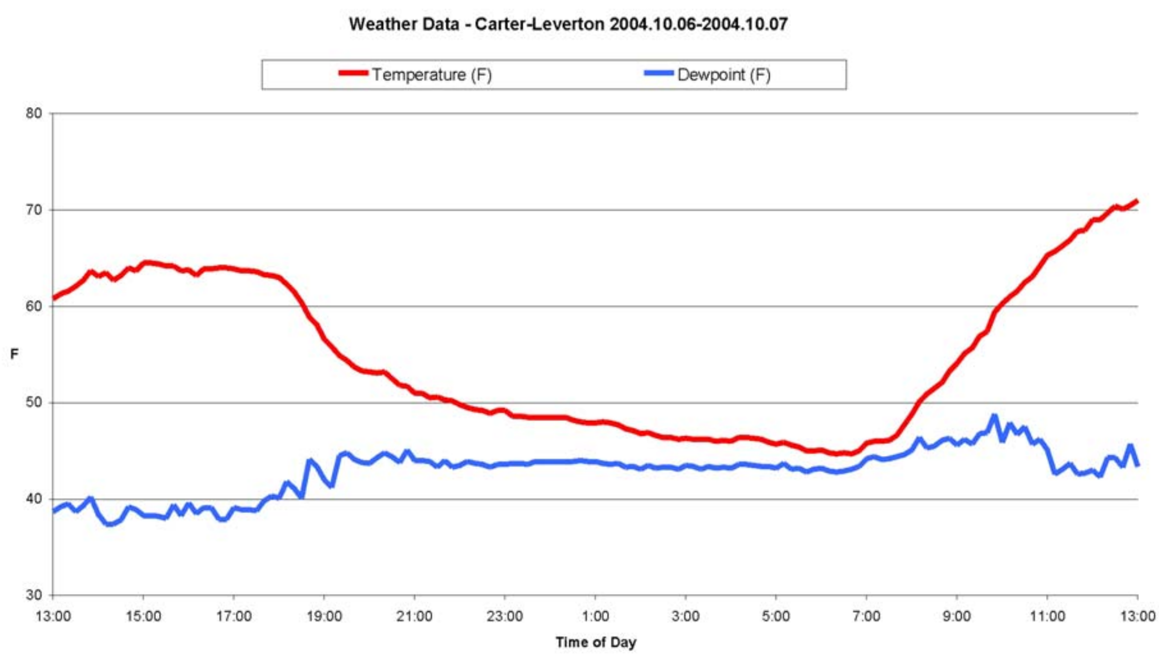


Figure A.1b: Weather Data – Carter Road & Leverton Road Study Area



A.2 College Gardens

Table A.2a – Noise Monitoring Data Summary (dBA): College Gardens							
Location	**$L_{eq(h)}$**	**L_{max}**	**L_{10}**	**L_{90}**	**L_{dn}**	**L_{eq24h}**	**Comment**
1304 Princeton Place	57	69	59	55	58	53	24-hr
Yale St – top of berm	71	91	74	64	71	68	24-hr
Yale St – H-B path	57*	64	60*	53*	N/A	N/A	Short-term
Yale & Fordham	53*	69	58*	50*	N/A	N/A	Short-term
College & Princeton	65**	87	72**	53**	N/A	N/A	Short-term
Baylor & Princeton	54**	72	58*	49**	N/A	N/A	Short-term
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.							
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Yale Street – top of berm*							
***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 1304 Princeton Place*							

Table A.2b – Noise Monitoring Data (dBA): 1304 Princeton Place						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
15:00	1:00:00	53	68	56	50	
16:00	1:00:00	49	62	50	47	
17:00	1:00:00	49	63	51	46	
18:00	1:00:00	51	64	53	49	
19:00	1:00:00	51	62	53	49	
20:00	1:00:00	51	61	52	50	
21:00	1:00:00	51	61	52	50	
22:00	1:00:00	51	57	52	51	
23:00	1:00:00	50	63	51	49	
0:00	1:00:00	50	65	51	49	
1:00	1:00:00	49	58	50	48	
2:00	1:00:00	48	56	49	47	
3:00	1:00:00	48	56	50	47	
4:00	1:00:00	49	66	52	47	
5:00	1:00:00	54	69	57	51	
6:00	1:00:00	55	67	57	52	
7:00	1:00:00	57	66	59	54	Loudest-hour $L_{eq(h)}$
8:00	1:00:00	55	69	56	53	
9:00	1:00:00	55	64	57	53	
10:00	1:00:00	56	69	59	54	
11:00	1:00:00	54	67	57	52	
12:00	1:00:00	57	69	59	55	Loudest-hour $L_{eq(h)}$
13:00	1:00:00	54	63	55	53	
14:00	1:00:00	54	57	55	52	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.2c – Noise Monitoring Data (dBA): Yale Street – Top of Berm						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
15:00	1:00:00	70	84	73	62	
16:00	1:00:00	69	79	72	62	
17:00	1:00:00	68	80	71	61	
18:00	1:00:00	68	79	72	60	
19:00	1:00:00	67	78	71	58	
20:00	1:00:00	66	80	70	57	
21:00	1:00:00	65	80	69	56	
22:00	1:00:00	62	79	67	54	

Table A.2c – Noise Monitoring Data (dBA): Yale Street – Top of Berm						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
23:00	1:00:00	61	78	65	54	
0:00	1:00:00	59	80	63	53	
1:00	1:00:00	60	83	63	53	
2:00	1:00:00	61	84	64	55	
3:00	1:00:00	60	81	64	54	
4:00	1:00:00	61	84	65	53	
5:00	1:00:00	66	88	70	56	
6:00	1:00:00	69	83	73	59	
7:00	1:00:00	70	82	74	62	
8:00	1:00:00	70	88	73	64	
9:00	1:00:00	69	83	72	62	
10:00	1:00:00	69	91	74	62	
11:00	1:00:00	70	83	73	62	
12:00	1:00:00	70	89	73	63	
13:00	1:00:00	70	82	74	62	
14:00	1:00:00	71	86	74	63	Loudest-hour $L_{eq(h)}$
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.2d – Noise Monitoring Data (dBA): Yale Street – Hiker-Biker Path						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:07:00	0:01:00	57.5	63.6	60	54	
12:08:00	0:01:00	54.1	57.4	56	50	
12:09:00	0:01:00	56	61	60	52	
12:10:00	0:01:00	55.5	57.4	56	54	
12:11:00	0:01:00	53.6	56.2	56	52	
12:12:00	0:01:00	55.8	61.3	60	52	
12:13:00	0:01:00	55.4	60.4	58	52	
12:14:00	0:01:00	56.3	64.2	60	50	
12:15:00	0:01:00	56.4	59.4	58	52	
12:16:00	0:01:00	54.7	59	58	52	
12:17:00	0:01:00	56.3	59.8	60	52	
12:18:00	0:01:00	55.5	58.5	58	52	
12:19:00	0:01:00	55.7	59.4	58	52	
12:20:00	0:01:00	55.2	58.5	58	52	
12:21:00	0:01:00	55.7	60.6	58	52	
12:22:00	0:01:00	55.7	59.1	58	50	
12:23:00	0:01:00	55.3	60.1	58	52	
12:24:00	0:01:00	54.6	60.2	60	52	
12:25:00	0:01:00	57.3	63.3	62	54	
12:26:00	0:01:00	52.7	55.7	54	50	
12:27:00	0:01:00	55.5	58.2	58	52	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.2e – Noise Monitoring Data (dBA): Yale Street & Fordham Street						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:07:00	0:01:00	52.5	57.8	55	50	
12:08:00	0:01:00	50.9	56.7	54	49	
12:09:00	0:01:00	50.6	57	52	49	
12:10:00	0:01:00	49.1	50.2	49	48	

Table A.2e – Noise Monitoring Data (dBA): Yale Street & Fordham Street						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:11:00	0:01:00	49.3	51	50	48	
12:12:00	0:01:00	50.1	56.6	51	48	
12:13:00	0:01:00	51.5	57.6	55	48	
12:14:00	0:01:00	51.5	54.6	52	50	
12:15:00	0:01:00	50.6	53	51	49	
12:16:00	0:01:00	52.2	58.8	55	49	
12:17:00	0:01:00	58.1	71.7	64	50	Despiked – statistical outlier
12:18:00	0:01:00	52.3	57.8	55	50	
12:19:00	0:01:00	51.3	54.6	53	50	
12:20:00	0:01:00	52.3	55.6	53	51	
12:21:00	0:01:00	57.2	69.2	64	49	
12:22:00	0:01:00	51.6	57.2	55	49	
12:23:00	0:01:00	50.6	52.7	51	49	
12:24:00	0:01:00	50.6	53.1	51	49	
12:25:00	0:01:00	52.2	54.3	53	51	
12:26:00	0:01:00	50.4	53	51	49	
12:27:00	0:01:00	52.5	54.6	53	50	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.2f – Noise Monitoring Data (dBA): College Parkway & Princeton Place						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:38:00	0:01:00	62.9	77.4	70	50	
12:39:00	0:01:00	64.1	76.6	70	54	
12:40:00	0:01:00	61.9	70.1	68	56	
12:41:00	0:01:00	60.7	68.6	64	52	
12:42:00	0:01:00	60.6	68.2	64	54	
12:43:00	0:01:00	58.5	69	64	50	
12:44:00	0:01:00	71.7	84.9	80	54	
12:45:00	0:01:00	70.9	86.7	80	50	
12:46:00	0:01:00	56.9	67.6	62	48	
12:47:00	0:01:00	64.3	76.5	68	56	
12:48:00	0:01:00	54.1	61.9	60	50	
12:49:00	0:01:00	59.9	69.9	66	52	
12:50:00	0:01:00	61	73.5	66	50	
12:51:00	0:01:00	60.9	71.9	68	50	
12:52:00	0:01:00	63.6	72.5	70	54	
12:53:00	0:01:00	61.6	70.7	66	52	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.2g – Noise Monitoring Data (dBA): Baylor Avenue & Princeton Place						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:38:00	0:01:00	49.6	55.4	50	48	
12:39:00	0:01:00	54.4	65.9	57	50	
12:40:00	0:01:00	54.6	67.9	58	49	
12:41:00	0:01:00	53.5	58.2	56	51	
12:42:00	0:01:00	50.9	53.8	52	49	
12:43:00	0:01:00	55.7	69.1	60	50	
12:44:00	0:01:00	57.1	68.3	62	51	
12:45:00	0:01:00	49.9	51.5	50	48	

Table A.2g – Noise Monitoring Data (dBA): Baylor Avenue & Princeton Place						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:46:00	0:01:00	54.5	67.6	60	48	
12:47:00	0:01:00	53.4	67.5	55	48	
12:48:00	0:01:00	52.8	64.4	57	49	
12:49:00	0:01:00	56	66.6	62	49	
12:50:00	0:01:00	54.7	72	57	48	
12:51:00	0:01:00	52.9	65.5	56	49	
12:52:00	0:01:00	54.9	66.6	60	49	
12:53:00	0:01:00	54.9	60.2	57	52	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Figure A.2a: Diurnal $L_{eq(h)}$ Plot – College Gardens Study Area

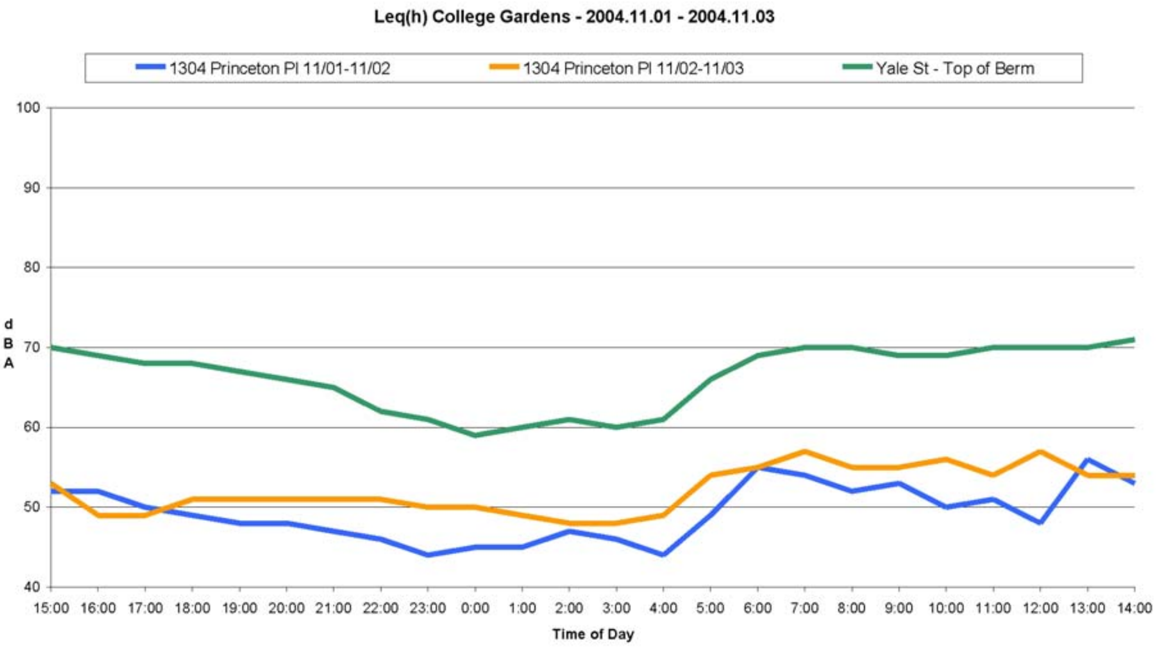
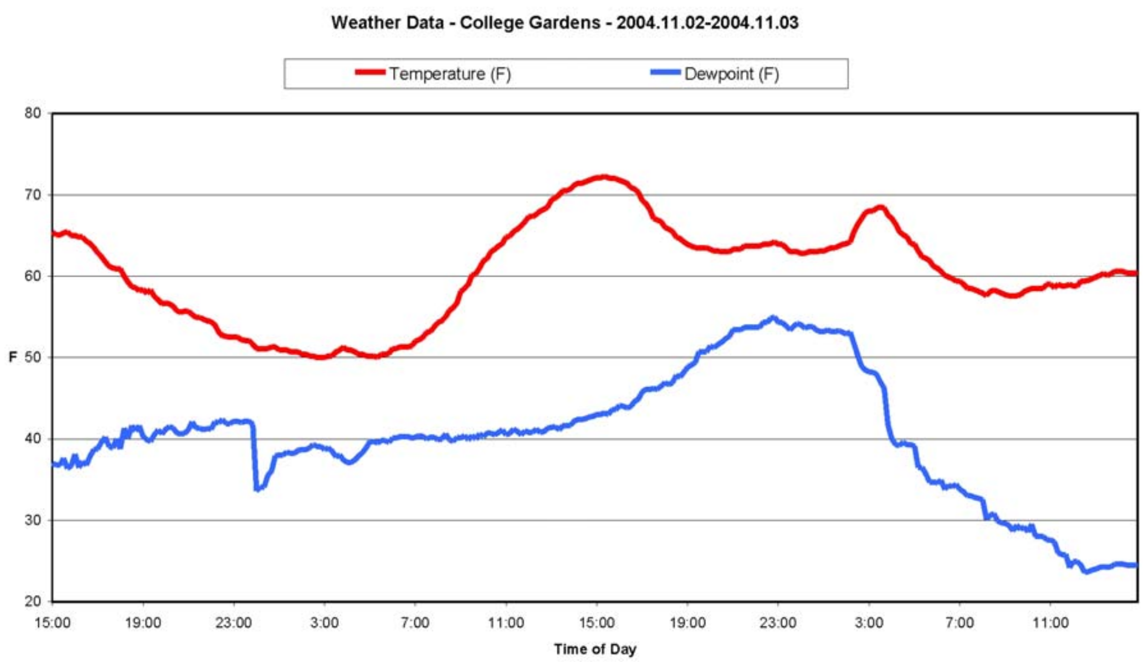


Figure A.2b: Weather Data – College Gardens Study Area



A.3 Glenora Hills (Glenora Hills, Griffith Oaks, Rockshire)

Table A.3a – Noise Monitoring Data Summary (dBA): Glenora Hills (Glenora Hills, Griffith Oaks, Rockshire)							
Location	**$L_{eq(h)}$**	**L_{max}**	**L_{10}**	**L_{90}**	**L_{dn}**	**L_{eq24h}**	**Comment**
Wootton & Darnestown	71	88	74	67	70	67	24-hr. Top of berm
Wootton & Keynes	65	82	69	59	64	61	24-hr. Lot line on Keynes Rd.
Glenora Lane & Terr.	54*	77	61*	46*	N/A	N/A	Short-term. 1 block S of Darnestown.
Glenora & Darnestown	76*	87	79*	66*	N/A	N/A	Short-term. Lot-line on Glenora Ln.
Balmoral Dr. & Dundee	55**	70	60**	46**	N/A	N/A	Short-term.
Balmoral Dr. & Ct.	48**	68	52**	45**	N/A	N/A	Short-term.
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.							
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Wootton Parkway & Darnestown Road*							
***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Wootton Parkway & Keynes Road*							

Table A.3b – Noise Monitoring Data (dBA): Wootton Parkway & Darnestown Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
15:00	1:00:00	69	85	72	63	
16:00	1:00:00	68	88	71	62	
17:00	1:00:00	67	82	70	63	
18:00	1:00:00	67	82	70	63	
19:00	1:00:00	66	75	69	61	
20:00	1:00:00	65	78	69	58	
21:00	1:00:00	64	77	68	57	
22:00	1:00:00	63	77	67	55	
23:00	1:00:00	60	73	64	51	
0:00	1:00:00	58	73	63	49	
1:00	1:00:00	55	75	60	46	
2:00	1:00:00	54	69	58	48	
3:00	1:00:00	56	74	60	49	
4:00	1:00:00	58	74	62	50	
5:00	1:00:00	64	78	69	55	
6:00	1:00:00	69	84	72	63	
7:00	1:00:00	70	84	73	65	
8:00	1:00:00	70	82	73	66	
9:00	1:00:00	69	80	72	64	
10:00	1:00:00	70	86	73	63	
11:00	1:00:00	71	88	74	67	Loudest-hour $L_{eq(h)}$
12:00	1:00:00	68	88	72	62	
13:00	1:00:00	68	83	72	61	
14:00	1:00:00	69	85	73	63	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.3c – Noise Monitoring Data (dBA): Wootton Parkway & Keynes Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
15:00	1:00:00	64	85	72	54	
16:00	1:00:00	63	88	71	55	
17:00	1:00:00	64	82	70	57	
18:00	1:00:00	63	82	70	55	
19:00	1:00:00	61	75	69	52	
20:00	1:00:00	60	78	69	50	

Table A.3c – Noise Monitoring Data (dBA): Wootton Parkway & Keynes Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
21:00	1:00:00	58	77	68	49	
22:00	1:00:00	57	77	67	46	
23:00	1:00:00	54	73	64	45	
0:00	1:00:00	50	73	63	43	
1:00	1:00:00	49	75	60	42	
2:00	1:00:00	48	69	58	45	
3:00	1:00:00	48	74	60	45	
4:00	1:00:00	50	74	62	48	
5:00	1:00:00	56	78	69	51	
6:00	1:00:00	62	84	72	55	
7:00	1:00:00	65	84	73	57	Loudest-hour $L_{eq(h)}$
8:00	1:00:00	65	82	73	59	Loudest-hour $L_{eq(h)}$
9:00	1:00:00	64	80	72	53	
10:00	1:00:00	61	86	73	48	
11:00	1:00:00	62	88	74	49	
12:00	1:00:00	62	88	72	49	
13:00	1:00:00	61	83	72	49	
14:00	1:00:00	65	85	73	52	Loudest-hour $L_{eq(h)}$
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.3d – Noise Monitoring Data (dBA): Glenora Lane & Glenmore Terrace						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:55:00	0:01:00	53.7	71	60	44	
13:56:00	0:01:00	49.5	62.3	56	44	
13:57:00	0:01:00	48.3	53.4	52	44	
13:58:00	0:01:00	62.3	83.6	64	46	Despiked – statistical outlier
13:59:00	0:01:00	59.6	76.7	62	48	
14:00:00	0:01:00	65.2	80.6	72	60	Despiked – statistical outlier
14:01:00	0:01:00	48.1	55.1	52	46	
14:02:00	0:01:00	60.4	72.7	70	46	
14:03:00	0:01:00	45.2	53.7	48	44	
14:04:00	0:01:00	44.7	46.6	46	44	
14:05:00	0:01:00	52.1	66.1	56	46	
14:06:00	0:01:00	48.4	64.5	50	44	
14:07:00	0:01:00	49.3	58.9	54	46	
14:08:00	0:01:00	51.1	60.7	56	48	
14:09:00	0:01:00	48.6	54.2	50	44	
14:10:00	0:01:00	45.9	51.4	48	44	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.3e – Noise Monitoring Data (dBA): Glenora Lane & Darnestown Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:55:00	0:01:00	73.7	83.1	79	57	
13:56:00	0:01:00	74.4	80.7	78	63	
13:57:00	0:01:00	73	85.6	76	61	
13:58:00	0:01:00	74.5	83.9	78	63	
13:59:00	0:01:00	74.5	85.9	79	51	
14:00:00	0:01:00	77.8	87.2	81	72	
14:01:00	0:01:00	74.4	85.5	78	64	

Table A.3e – Noise Monitoring Data (dBA): Glenora Lane & Darnestown Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
14:02:00	0:01:00	75.7	83.4	79	68	
14:03:00	0:01:00	68.2	76.2	73	54	Break in EB traffic for contiguous minute
14:04:00	0:01:00	76.6	86.3	81	66	
14:05:00	0:01:00	74.2	84.3	77	64	
14:06:00	0:01:00	73.4	82.1	77	63	
14:07:00	0:01:00	75	80.8	78	69	
14:08:00	0:01:00	66	75.1	73	50	Break in EB traffic for contiguous minute
14:09:00	0:01:00	76.5	86.9	79	68	
14:10:00	0:01:00	75.9	86.9	80	59	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.3f – Noise Monitoring Data (dBA): Balmoral Drive & Dundee Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
14:20:00	0:01:00	55.2	66.3	59	49	
14:21:00	0:01:00	54.3	64.7	57	46	
14:22:00	0:01:00	53.1	62.2	58	45	
14:23:00	0:01:00	53.7	61.3	57	47	
14:24:00	0:01:00	54.5	66.2	61	46	
14:25:00	0:01:00	54.9	64.3	59	47	
14:26:00	0:01:00	57.6	66.9	63	47	
14:27:00	0:01:00	53.8	65.5	62	44	
14:28:00	0:01:00	54	63.8	61	44	
14:29:00	0:01:00	56.3	69.9	64	44	
14:30:00	0:01:00	47.4	53.5	49	44	
14:31:00	0:01:00	52.5	66.7	59	45	
14:32:00	0:01:00	57.7	67.5	63	48	
14:33:00	0:01:00	50.1	63.9	55	43	
14:34:00	0:01:00	45.7	51.8	47	43	
14:35:00	0:01:00	56.5	66.8	62	48	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.3g – Noise Monitoring Data (dBA): Balmoral Drive & Balmoral Court						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
14:20:00	0:01:00	46.3	48.6	48	46	
14:21:00	0:01:00	45.6	47.4	48	44	
14:22:00	0:01:00	46.7	49.8	48	46	
14:23:00	0:01:00	47.5	54.1	50	44	
14:24:00	0:01:00	51	55.9	54	46	
14:25:00	0:01:00	45.5	48.1	46	44	
14:26:00	0:01:00	54.5	63	60	48	
14:27:00	0:01:00	49.9	60.9	56	44	
14:28:00	0:01:00	45	48.9	46	44	
14:29:00	0:01:00	51.3	68	56	44	
14:30:00	0:01:00	43.4	45.8	44	42	
14:31:00	0:01:00	44.6	46.2	46	44	
14:32:00	0:01:00	44.7	47.7	46	44	
14:33:00	0:01:00	43.9	45.5	44	44	
14:34:00	0:01:00	43.1	45	44	42	
14:35:00	0:01:00	44.1	49.2	46	42	

Table A.3g – Noise Monitoring Data (dBA): Balmoral Drive & Balmoral Court						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Figure A.3a: Diurnal $L_{eq(h)}$ Plot – Glenora Hills Study Area

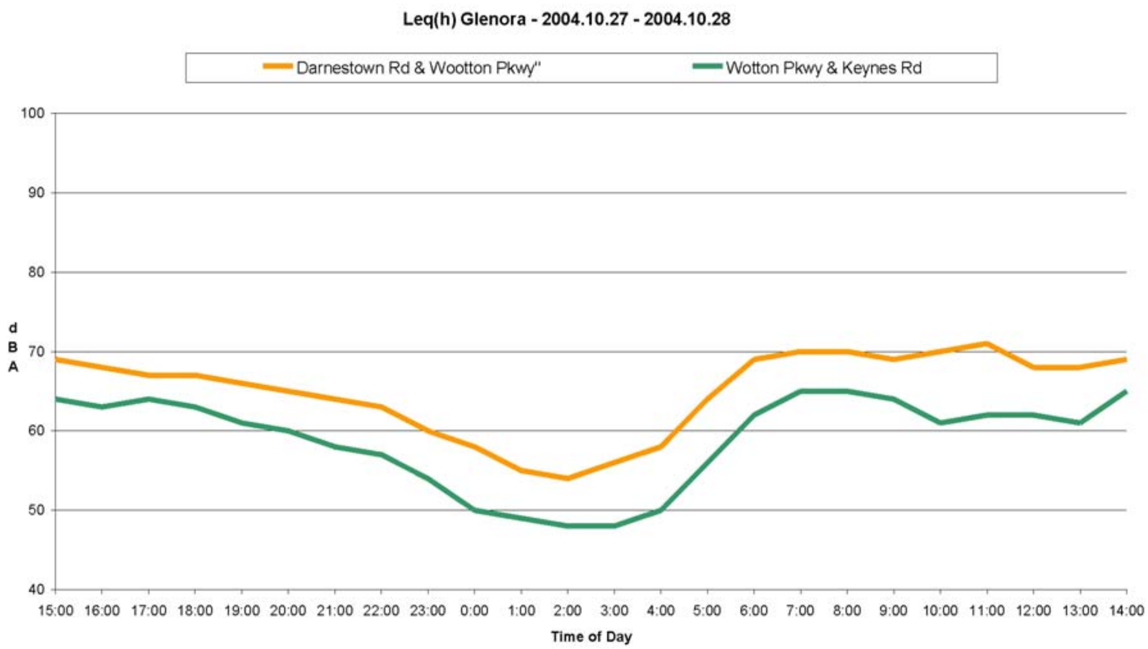
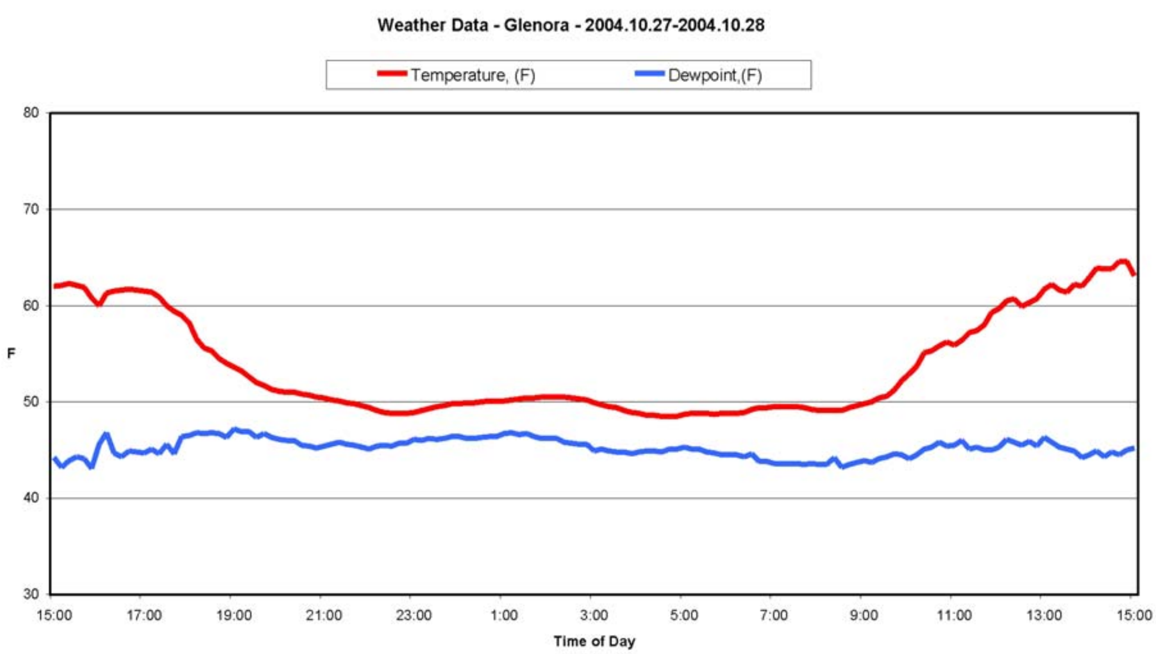


Figure A.3b: Weather Data – Glenora Hills Study Area



A.4 Nelson Street (West End Park)

Table A.4a – Noise Monitoring Data Summary (dBA): Nelson Street (West End Park)							
Location	**$L_{eq(h)}$**	**L_{max}**	**L_{10}**	**L_{90}**	**L_{dn}**	**L_{eq24h}**	**Comment**
5 Nelson St.	70	83	72	66	69	65	24-hour
203 Nelson St.	76	88	77	74	74	71	24-hour
9 Owens Ct.	69	83	72	64	71	66	24-hour
Mannakee – 50' N	66*	77	69*	63*	N/A	N/A	Short-term
Mannakee – 200' N	62*	76	67*	54*	N/A	N/A	Short-term
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.							
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 5 Nelson Street.*							

Table A.4b – Noise Monitoring Data (dBA): 5 Nelson Street						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:00	1:00:00	67	79	70	65	
14:00	1:00:00	68	78	70	65	
15:00	1:00:00	66	74	67	64	
16:00	1:00:00	66	74	67	65	
17:00	1:00:00	66	71	67	65	
18:00	1:00:00	66	72	66	65	
19:00	1:00:00	65	71	66	64	
20:00	1:00:00	64	68	65	63	
21:00	1:00:00	64	74	66	63	
22:00	1:00:00	62	78	64	61	
23:00	1:00:00	61	69	62	59	
0:00	1:00:00	60	66	61	57	
1:00	1:00:00	59	68	61	56	
2:00	1:00:00	59	69	61	56	
3:00	1:00:00	61	68	63	59	
4:00	1:00:00	64	73	65	63	
5:00	1:00:00	65	71	66	64	
6:00	1:00:00	64	75	65	63	
7:00	1:00:00	65	71	66	64	
8:00	1:00:00	67	76	69	65	
9:00	1:00:00	66	75	68	64	
10:00	1:00:00	65	71	66	64	
11:00	1:00:00	65	79	67	63	
12:00	1:00:00	70	83	72	66	Loudest-hour $L_{eq(h)}$
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.4c – Noise Monitoring Data (dBA): 203 Nelson Street						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:00	1:00:00	72	83	75	69	
14:00	1:00:00	72	84	75	69	
15:00	1:00:00	72	85	75	68	
16:00	1:00:00	72	83	75	69	
17:00	1:00:00	72	84	75	69	
18:00	1:00:00	72	82	74	69	
19:00	1:00:00	71	82	74	68	
20:00	1:00:00	71	83	74	68	
21:00	1:00:00	69	79	72	66	
22:00	1:00:00	67	83	69	64	

Table A.4c – Noise Monitoring Data (dBA): 203 Nelson Street						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
23:00	1:00:00	65	80	67	62	
0:00	1:00:00	63	74	65	60	
1:00	1:00:00	62	78	65	59	
2:00	1:00:00	63	81	65	59	
3:00	1:00:00	64	83	66	61	
4:00	1:00:00	68	84	70	65	
5:00	1:00:00	70	82	72	67	
6:00	1:00:00	72	88	74	68	
7:00	1:00:00	72	86	75	69	
8:00	1:00:00	72	83	75	69	
9:00	1:00:00	72	85	74	68	
10:00	1:00:00	72	84	74	68	
11:00	1:00:00	72	84	75	68	
12:00	1:00:00	76	84	77	74	Loudest-hour $L_{eq(h)}$
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.4d – Noise Monitoring Data (dBA): 9 Owens Court						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:00	1:00:00	68	81	71	62	
14:00	1:00:00	67	80	71	62	
15:00	1:00:00	67	80	71	62	
16:00	1:00:00	67	81	70	62	
17:00	1:00:00	67	77	70	64	
18:00	1:00:00	68	80	71	64	
19:00	1:00:00	68	81	71	64	
20:00	1:00:00	67	79	70	63	
21:00	1:00:00	66	83	69	62	
22:00	1:00:00	63	79	66	60	
23:00	1:00:00	61	78	63	58	
0:00	1:00:00	60	75	62	57	
1:00	1:00:00	59	78	61	55	
2:00	1:00:00	58	76	60	55	
3:00	1:00:00	60	78	61	58	
4:00	1:00:00	64	80	66	62	
5:00	1:00:00	66	83	69	63	
6:00	1:00:00	68	82	72	62	
7:00	1:00:00	68	78	72	63	
8:00	1:00:00	68	80	72	62	
9:00	1:00:00	68	80	72	61	
10:00	1:00:00	69	80	72	62	Loudest-hour $L_{eq(h)}$
11:00	1:00:00	69	80	72	63	Loudest-hour $L_{eq(h)}$
12:00	1:00:00	67	78	71	61	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.4e – Noise Monitoring Data (dBA): Mannakee Street – 50' N. of West Montgomery Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:41:00	0:01:00	65.4	70.6	66	62	
12:42:00	0:01:00	66.3	76.3	70	62	

Table A.4e – Noise Monitoring Data (dBA): Mannakee Street – 50' N. of West Montgomery Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:43:00	0:01:00	65	69	70	62	
12:44:00	0:01:00	64.1	67.3	70	62	
12:45:00	0:01:00	65.8	74.7	66	60	
12:46:00	0:01:00	67.6	76.7	70	64	
12:47:00	0:01:00	65.8	71.9	70	62	
12:48:00	0:01:00	64.3	69.5	70	64	
12:49:00	0:01:00	67.4	75.3	70	64	
12:50:00	0:01:00	66.2	72.3	80	64	
12:51:00	0:01:00	67.1	73.8	72	68	
12:52:00	0:01:00	67.6	75.8	70	58	
12:53:00	0:01:00	75.2	94	66	62	Despiked – statistical outlier
12:54:00	0:01:00	69.7	72.2	70	62	
12:55:00	0:01:00	65.7	73.1	70	62	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.4f – Noise Monitoring Data (dBA): Mannakee Street – 200' N. of West Montgomery Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:41:00	0:01:00	61.7	70	67	55	
12:42:00	0:01:00	61.8	69.1	66	55	
12:43:00	0:01:00	64.6	75.9	68	56	
12:44:00	0:01:00	59.8	67.9	64	54	
12:45:00	0:01:00	61.6	71.3	67	55	
12:46:00	0:01:00	60.6	72.3	65	54	
12:47:00	0:01:00	61	72.4	66	54	
12:48:00	0:01:00	59.8	73.5	65	54	
12:49:00	0:01:00	61.1	73.6	68	55	
12:50:00	0:01:00	62.4	71.1	69	54	
12:51:00	0:01:00	60.7	70.7	67	53	
12:52:00	0:01:00	60.9	69.5	67	53	
12:53:00	0:01:00	69.5	85	75	56	Despiked – statistical outlier
12:54:00	0:01:00	62.7	65.9	63	61	
12:55:00	0:01:00	60.9	71.1	63	56	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Figure A.4a: Diurnal $L_{eq(h)}$ Plot – Nelson Street (West End Park) Study Area

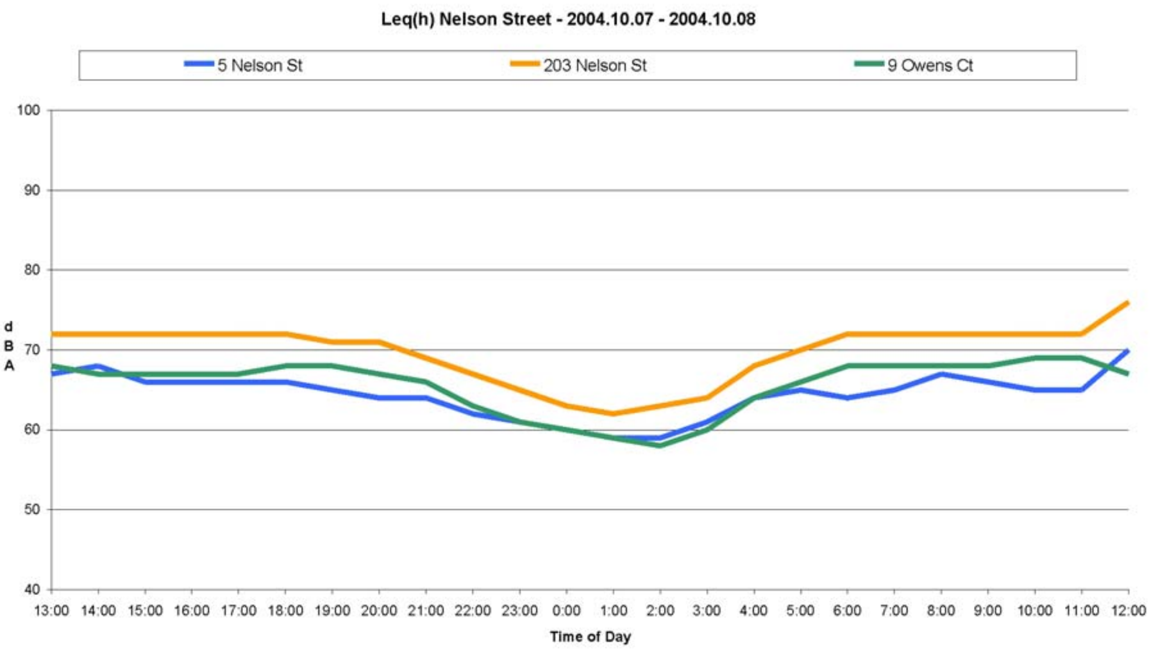
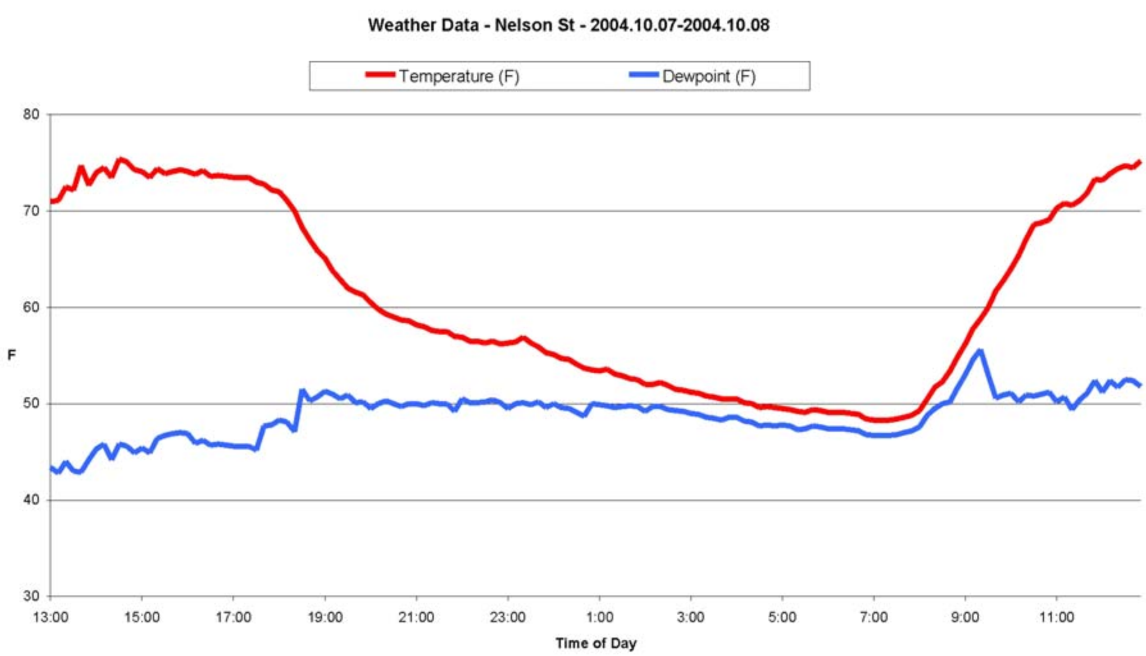


Figure A.4b: Weather Data – Nelson Street (West End Park) Study Area



A.5 Norbeck Road (Burgundy Knolls, East Rockville, Charles Walk, Maryvale, Redgate Farms)

Table A.5a – Noise Monitoring Data Summary (dBA): Norbeck Road (Burgundy Knolls, East Rockville, Charles Walk, Maryvale, Redgate Farms)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
Maryvale Park	55	70	58	53	56	51	24-hour
First St & Norbeck	74	96	78	67	75	71	24-hour
Grandin & First Street	71	84	72	71	68	65	24-hour
803 Grandin	61*	69	65*	58*	N/A	N/A	Short-term
704 Grandin	54*	69	56*	52*	N/A	N/A	Short-term
Baltimore & Grandin	63*	79	70*	51*	N/A	N/A	Short-term
Croydon & Grandin	50*	67	54*	45*	N/A	N/A	Short-term

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Grandin Avenue and Norbeck Road.*

Table A.5b – Noise Monitoring Data (dBA): Maryvale Park

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
15:00	1:00:00	49	58	52	47	
16:00	1:00:00	51	68	54	48	
17:00	1:00:00	52	68	55	48	
18:00	1:00:00	52	66	54	50	
19:00	1:00:00	50	65	52	49	
20:00	1:00:00	49	57	50	48	
21:00	1:00:00	51	58	52	50	
22:00	1:00:00	50	59	51	49	
23:00	1:00:00	48	57	49	47	
0:00	1:00:00	45	54	46	44	
1:00	1:00:00	46	63	48	44	
2:00	1:00:00	46	56	48	44	
3:00	1:00:00	45	54	47	44	
4:00	1:00:00	49	58	51	48	
5:00	1:00:00	51	63	52	49	
6:00	1:00:00	54	64	55	53	
7:00	1:00:00	54	69	56	53	
8:00	1:00:00	55	69	58	53	Loudest-hour $L_{eq(h)}$
9:00	1:00:00	53	70	56	49	
10:00	1:00:00	51	66	53	49	
11:00	1:00:00	49	59	50	47	
12:00	1:00:00	48	62	50	46	
13:00	1:00:00	48	65	50	45	
14:00	1:00:00	50	69	53	45	

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.

Table A.5c – Noise Monitoring Data (dBA): First Street & Norbeck Road

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
15:00	1:00:00	72	84	76	66	
16:00	1:00:00	72	88	75	67	
17:00	1:00:00	72	83	74	66	
18:00	1:00:00	71	84	74	66	
19:00	1:00:00	70	82	74	63	

Table A.5c – Noise Monitoring Data (dBA): First Street & Norbeck Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
20:00	1:00:00	69	87	73	60	
21:00	1:00:00	69	83	73	59	
22:00	1:00:00	68	79	72	56	
23:00	1:00:00	65	83	70	50	
0:00	1:00:00	63	85	67	47	
1:00	1:00:00	61	82	65	43	
2:00	1:00:00	59	81	62	46	
3:00	1:00:00	61	85	65	44	
4:00	1:00:00	64	83	68	48	
5:00	1:00:00	69	84	74	57	
6:00	1:00:00	73	86	76	64	
7:00	1:00:00	72	90	76	66	
8:00	1:00:00	73	92	76	66	
9:00	1:00:00	72	90	76	64	
10:00	1:00:00	74	96	78	66	
11:00	1:00:00	73	90	77	67	
12:00	1:00:00	73	89	76	67	
13:00	1:00:00	74	92	77	67	Loudest-hour $L_{eq(h)}$
14:00	1:00:00	72	85	76	66	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.5d – Noise Monitoring Data (dBA): Grandin Avenue & First Street						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
15:00	1:00:00	71	78	71	70	Loudest-hour $L_{eq(h)}$
16:00	1:00:00	71	80	72	71	Loudest-hour $L_{eq(h)}$
17:00	1:00:00	69	75	69	68	
18:00	1:00:00	63	74	65	61	
19:00	1:00:00	62	77	64	58	
20:00	1:00:00	61	71	63	57	
21:00	1:00:00	60	72	63	56	
22:00	1:00:00	60	69	63	56	
23:00	1:00:00	60	69	62	57	
0:00	1:00:00	59	71	60	57	
1:00	1:00:00	58	70	59	57	
2:00	1:00:00	58	70	59	57	
3:00	1:00:00	57	70	59	56	
4:00	1:00:00	58	70	61	56	
5:00	1:00:00	61	72	64	57	
6:00	1:00:00	64	79	67	60	
7:00	1:00:00	65	78	68	60	
8:00	1:00:00	65	79	68	60	
9:00	1:00:00	66	84	70	63	
10:00	1:00:00	65	79	68	62	
11:00	1:00:00	65	80	68	61	
12:00	1:00:00	65	78	68	62	
13:00	1:00:00	66	80	69	63	
14:00	1:00:00	66	78	68	64	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.5e – Noise Monitoring Data (dBA): 803 Grandin Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:05:00	0:01:00	55.5	59.7	58	54	
12:06:00	0:01:00	52.9	60.6	54	50	
12:07:00	0:01:00	56.2	64.1	62	52	
12:08:00	0:01:00	60.1	69.1	66	56	
12:09:00	0:01:00	53.4	62.6	58	50	
12:10:00	0:01:00	53.2	61.3	56	50	
12:11:00	0:01:00	57.3	65	60	54	
12:12:00	0:01:00	56.4	66	58	54	
12:13:00	0:01:00	57	67.6	62	52	
12:14:00	0:01:00	58.6	68.2	62	54	
12:15:00	0:01:00	54.2	58.6	56	52	
12:16:00	0:01:00	54.4	61.2	58	52	
12:17:00	0:01:00	55	60.4	58	52	
12:18:00	0:01:00	50.2	52.7	52	48	
12:19:00	0:01:00	53.4	59.6	56	50	
12:20:00	0:01:00	57.3	65.5	60	54	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.5f – Noise Monitoring Data (dBA): 704 Grandin Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:05:00	0:01:00	46	48.2	47	45	
12:06:00	0:01:00	48.3	51.8	49	46	
12:07:00	0:01:00	49.2	52.2	49	48	
12:08:00	0:01:00	49	50.7	49	48	
12:09:00	0:01:00	49.4	51.9	50	48	
12:10:00	0:01:00	54.6	69.4	59	47	
12:11:00	0:01:00	49.1	49.9	49	48	
12:12:00	0:01:00	49.9	51.3	50	49	
12:13:00	0:01:00	49.7	52.9	51	46	
12:14:00	0:01:00	49	53.1	50	47	
12:15:00	0:01:00	49.9	53.1	51	48	
12:16:00	0:01:00	48.8	50.1	49	48	
12:17:00	0:01:00	49.7	52.9	51	48	
12:18:00	0:01:00	48.6	49.8	49	48	
12:19:00	0:01:00	46.4	49	48	44	
12:20:00	0:01:00	45.2	48.1	46	44	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.5g – Noise Monitoring Data (dBA): Baltimore Road & Grandin Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:25:00	0:01:00	60.8	71	68	44	
12:26:00	0:01:00	58.3	68.9	66	46	
12:27:00	0:01:00	62	72.6	70	50	
12:28:00	0:01:00	62.1	72.1	68	48	
12:29:00	0:01:00	58.4	75.9	64	48	
12:30:00	0:01:00	74.4	90.9	80	58	Despiked – statistical outlier
12:31:00	0:01:00	62.1	74.6	70	48	
12:32:00	0:01:00	63.1	72.7	70	50	

Table A.5g – Noise Monitoring Data (dBA): Baltimore Road & Grandin Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:33:00	0:01:00	66	76.9	70	58	
12:34:00	0:01:00	63	76	72	46	
12:35:00	0:01:00	61.2	73.8	70	46	
12:36:00	0:01:00	66.2	75.7	72	54	
12:37:00	0:01:00	62.8	70.5	68	50	
12:38:00	0:01:00	56	72.6	64	46	
12:39:00	0:01:00	64.4	78.6	72	46	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.5h – Noise Monitoring Data (dBA): Croydon Avenue & Grandin Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:25:00	0:01:00	49.7	62.6	55	45	
12:26:00	0:01:00	45.4	49.9	47	43	
12:27:00	0:01:00	50.4	57.5	54	43	
12:28:00	0:01:00	48.9	57.3	52	45	
12:29:00	0:01:00	53.2	64.2	59	45	
12:30:00	0:01:00	47.8	55	50	45	
12:31:00	0:01:00	52.8	66.6	55	46	
12:32:00	0:01:00	51.8	63	55	46	
12:33:00	0:01:00	49.9	55.4	52	46	
12:34:00	0:01:00	50.1	57	54	45	
12:35:00	0:01:00	45.7	49.8	47	43	
12:36:00	0:01:00	45.5	49.1	47	44	
12:37:00	0:01:00	50.2	61.1	55	44	
12:38:00	0:01:00	55.6	72.5	59	46	Despiked – statistical outlier
12:39:00	0:01:00	47.2	57.1	50	44	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Figure A.5a: Diurnal $L_{eq(h)}$ Plot – Norbeck Road (Burgundy Knolls, East Rockville, Charles Walk, Maryvale, Redgate Farms) Study Area

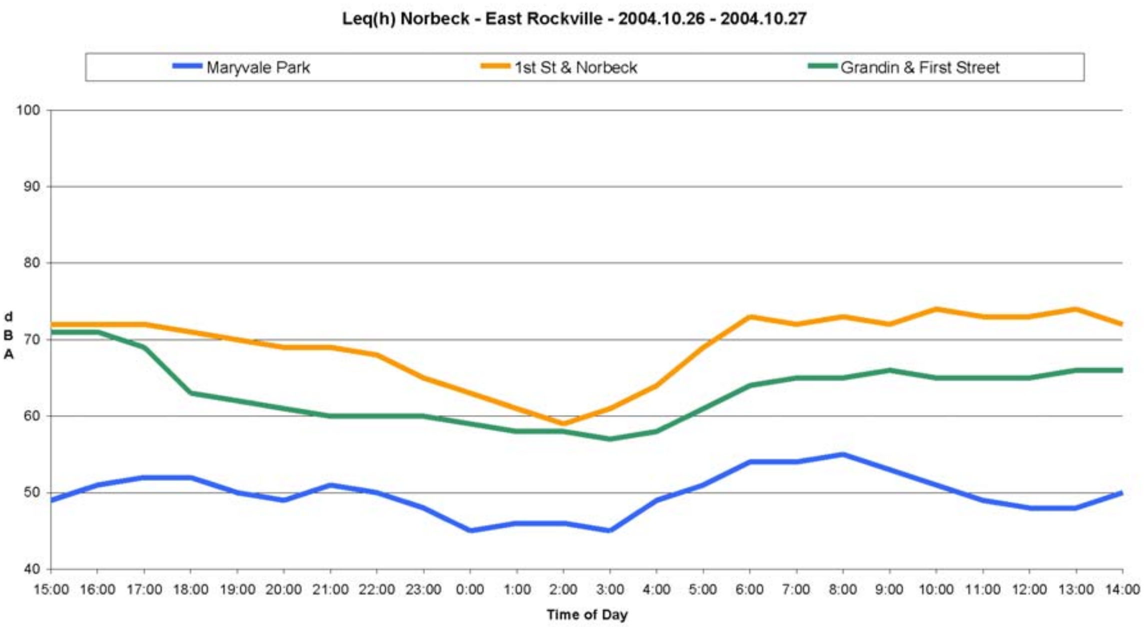
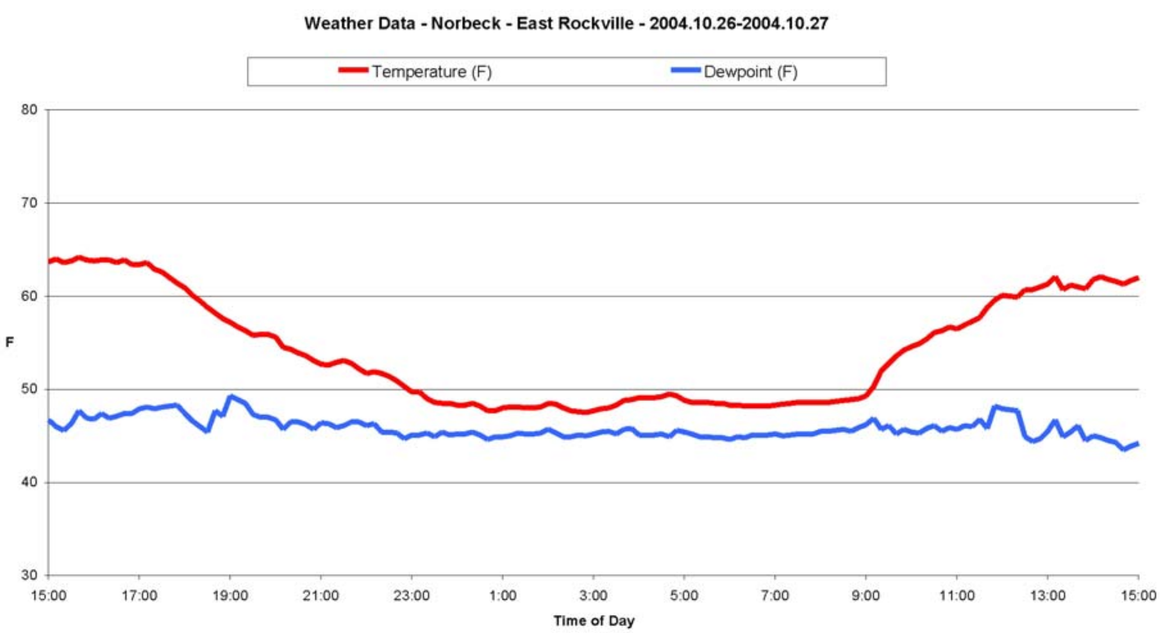


Figure A.5b: Weather Data – Norbeck Road (Burgundy Knolls, East Rockville, Charles Walk, Maryvale, Redgate Farms) Study Area



A.6 Norbeck Road (Burgundy Estates, Silver Rock, Twinbrook Forest)

Table A.6a – Noise Monitoring Data (dBA): Norbeck Road (Burgundy Estates, Silver Rock, Twinbrook Forest)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
624 Denham Road	66	88	69	61	67	64	24-hour
Silver Rock Park	53	69	56	51	52	48	24-hour
Veirs Mill & Edmonston	73	91	76	67	75	71	24-hour
Denham Court	60*	70	63*	57*	N/A	N/A	Short-term
Edmonston & Denham	62*	73	64*	58*	N/A	N/A	Short-term
Edmonston & Lyon	54*	65	59*	51*	N/A	N/A	Short-term
Burdette Road	53*	57	54*	51*	N/A	N/A	Short-term
Edmonston & Gilbert	55*	65	59*	50*	N/A	N/A	Short-term
Woodburn & Grandin	55**	67	59**	49**	N/A	N/A	Short-term
Broadwood & Balt.	60	76	65	47	N/A	N/A	Short-term
Broadwood & Bradley	55	73	62	46	N/A	N/A	Short-term
McAuliffe & Farragut	58**	74	63**	53**	N/A	N/A	Short-term
McAuliffe & Twinbrook	69**	83	73**	63**	N/A	N/A	Short-term
Marshall & Twinbrook	64**	78	68**	55**	N/A	N/A	Short-term
Marshall & Tweed	53**	68	56**	49**	N/A	N/A	Short-term

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 624 Denham Road*
***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Veirs Mill Road & Edmonston Road*

Table A.6b – Noise Monitoring Data (dBA): 624 Denham Road @ Norbeck Road

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
15:00	1:00:00	66	88	69	61	Loudest-hour $L_{eq(h)}$
16:00	1:00:00	66	79	68	61	Loudest-hour $L_{eq(h)}$
17:00	1:00:00	66	78	68	61	Loudest-hour $L_{eq(h)}$
18:00	1:00:00	65	78	67	61	
19:00	1:00:00	63	79	66	57	
20:00	1:00:00	61	73	65	54	
21:00	1:00:00	60	70	64	53	
22:00	1:00:00	59	70	63	51	
23:00	1:00:00	58	76	62	48	
0:00	1:00:00	55	72	60	46	
1:00	1:00:00	54	73	59	45	
2:00	1:00:00	53	72	58	46	
3:00	1:00:00	52	70	57	45	
4:00	1:00:00	55	76	59	47	
5:00	1:00:00	61	76	65	52	
6:00	1:00:00	64	75	67	59	
7:00	1:00:00	65	80	68	60	
8:00	1:00:00	65	76	68	61	
9:00	1:00:00	66	85	69	60	
10:00	1:00:00	65	86	68	59	
11:00	1:00:00	65	77	68	60	
12:00	1:00:00	66	84	69	60	
13:00	1:00:00	65	81	69	59	
14:00	1:00:00	66	85	69	60	Loudest-hour $L_{eq(h)}$

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.

Table A.6c – Noise Monitoring Data (dBA): Silver Rock Park						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
15:00	1:00:00	45	58	48	42	
16:00	1:00:00	47	59	49	43	
17:00	1:00:00	47	62	50	44	
18:00	1:00:00	49	62	51	46	
19:00	1:00:00	47	65	49	45	
20:00	1:00:00	46	64	48	45	
21:00	1:00:00	46	62	48	44	
22:00	1:00:00	45	56	47	44	
23:00	1:00:00	43	53	45	42	
0:00	1:00:00	43	56	45	42	
1:00	1:00:00	43	55	44	40	
2:00	1:00:00	42	56	43	40	
3:00	1:00:00	40	52	41	38	
4:00	1:00:00	43	58	45	40	
5:00	1:00:00	46	61	48	45	
6:00	1:00:00	50	62	51	49	
7:00	1:00:00	52	69	54	50	
8:00	1:00:00	53	68	56	51	Loudest-hour $L_{eq(h)}$
9:00	1:00:00	50	62	52	47	
10:00	1:00:00	48	63	50	45	
11:00	1:00:00	48	63	50	46	
12:00	1:00:00	45	58	47	43	
13:00	1:00:00	47	65	50	43	
14:00	1:00:00	47	62	50	43	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.6d – Noise Monitoring Data (dBA): Veirs Mill Road & Edmonston Drive						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
15:00	1:00:00	73	87	76	66	Loudest-hour $L_{eq(h)}$
16:00	1:00:00	73	86	76	66	Loudest-hour $L_{eq(h)}$
17:00	1:00:00	72	86	75	66	
18:00	1:00:00	72	84	75	65	
19:00	1:00:00	71	86	74	61	
20:00	1:00:00	70	85	74	61	
21:00	1:00:00	70	87	74	60	
22:00	1:00:00	69	86	73	57	
23:00	1:00:00	67	85	71	56	
0:00	1:00:00	65	85	69	53	
1:00	1:00:00	64	86	68	51	
2:00	1:00:00	61	82	65	49	
3:00	1:00:00	61	83	65	46	
4:00	1:00:00	64	82	69	53	
5:00	1:00:00	70	83	74	59	
6:00	1:00:00	72	86	76	65	
7:00	1:00:00	73	88	76	67	Loudest-hour $L_{eq(h)}$
8:00	1:00:00	72	91	75	67	
9:00	1:00:00	73	88	76	65	Loudest-hour $L_{eq(h)}$
10:00	1:00:00	73	88	76	63	Loudest-hour $L_{eq(h)}$
11:00	1:00:00	72	87	76	62	
12:00	1:00:00	72	86	76	62	

Table A.6d – Noise Monitoring Data (dBA): Veirs Mill Road & Edmonston Drive						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:00	1:00:00	73	90	76	63	Loudest-hour $L_{eq(h)}$
14:00	1:00:00	72	87	75	63	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.6e – Noise Monitoring Data (dBA): Dehnam Court						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:25:00	0:01:00	54	58.6	57	51	
11:26:00	0:01:00	55.7	58.7	58	52	
11:27:00	0:01:00	55.2	58.4	57	53	
11:28:00	0:01:00	55.9	59.1	58	54	
11:29:00	0:01:00	61.9	69.9	67	57	
11:30:00	0:01:00	55.7	62.6	57	54	
11:31:00	0:01:00	55.4	57.6	57	53	
11:32:00	0:01:00	54.6	56.7	55	53	
11:33:00	0:01:00	55.3	58.7	57	53	
11:34:00	0:01:00	57.1	60.5	59	55	
11:35:00	0:01:00	55.7	58.7	56	54	
11:36:00	0:01:00	57	58.6	58	55	
11:37:00	0:01:00	58	66.2	62	53	
11:38:00	0:01:00	55.9	58.5	57	54	
11:39:00	0:01:00	55.2	57.6	56	54	
11:40:00	0:01:00	57.4	69.5	65	52	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.6f – Noise Monitoring Data (dBA): Edmonston Drive & Dehnam Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:25:00	0:01:00	55.7	62.7	60	52	
11:26:00	0:01:00	59.7	63.3	62	56	
11:27:00	0:01:00	56.8	61.4	60	54	
11:28:00	0:01:00	58.3	67.8	60	54	
11:29:00	0:01:00	67.5	78.6	74	60	Despiked – statistical outlier
11:30:00	0:01:00	57.5	60.9	58	56	
11:31:00	0:01:00	58.9	64.1	62	56	
11:32:00	0:01:00	59.4	69.8	62	56	
11:33:00	0:01:00	57.8	63	60	56	
11:34:00	0:01:00	64.8	75.3	68	58	Despiked – statistical outlier
11:35:00	0:01:00	61.1	70.2	64	56	
11:36:00	0:01:00	60	65.3	64	56	
11:37:00	0:01:00	66.3	79.3	74	56	Despiked – statistical outlier
11:38:00	0:01:00	58.8	62.9	60	56	
11:39:00	0:01:00	56.6	59.8	58	56	
11:40:00	0:01:00	55.7	62.7	60	52	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.6g – Noise Monitoring Data (dBA): Edmonston Drive & Lyon Place						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:45:00	0:01:00	51	57.7	56	48	
11:46:00	0:01:00	49.7	53.8	52	48	
11:47:00	0:01:00	53.3	65.4	60	46	
11:48:00	0:01:00	52.3	59.4	54	50	
11:49:00	0:01:00	49.4	54.9	52	48	
11:50:00	0:01:00	51	54.6	52	50	
11:51:00	0:01:00	50.3	55.7	52	48	
11:52:00	0:01:00	59	73	66	48	Despiked – statistical outlier
11:53:00	0:01:00	52.8	60.3	56	48	
11:54:00	0:01:00	51.2	61.4	56	46	
11:55:00	0:01:00	50.7	53.4	52	48	
11:56:00	0:01:00	49.2	54.5	52	48	
11:57:00	0:01:00	49.9	55.8	52	48	
11:58:00	0:01:00	48.8	53.4	50	48	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.6h – Noise Monitoring Data (dBA): Burdette Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:45:00	0:01:00	50.1	52.8	51	47	
11:46:00	0:01:00	50.1	51.9	51	47	
11:47:00	0:01:00	50.5	53.3	52	48	
11:48:00	0:01:00	48.8	51.9	50	46	
11:49:00	0:01:00	51.1	53.9	52	49	
11:50:00	0:01:00	49.4	52.6	51	47	
11:51:00	0:01:00	51.3	52.8	52	49	
11:52:00	0:01:00	49.8	51.5	50	49	
11:53:00	0:01:00	49.5	52.3	51	48	
11:54:00	0:01:00	50.1	52.4	51	47	
11:55:00	0:01:00	48	49.3	49	47	
11:56:00	0:01:00	50.1	51.8	51	48	
11:57:00	0:01:00	49.2	51.5	51	47	
11:58:00	0:01:00	49.7	51.9	51	48	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.6i – Noise Monitoring Data (dBA): Edmonston Drive & Gilbert Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:10:00	0:01:00	52.4	61.8	54	50	
12:11:00	0:01:00	54	60.9	57	51	
12:12:00	0:01:00	55.2	64.7	60	51	
12:13:00	0:01:00	51.8	60.2	54	49	
12:14:00	0:01:00	51.4	59.4	53	49	
12:15:00	0:01:00	54.3	63.2	60	49	
12:16:00	0:01:00	56.3	65.1	61	50	
12:17:00	0:01:00	53.3	64.2	59	49	
12:18:00	0:01:00	52.8	57.6	53	50	
12:19:00	0:01:00	53.2	57.5	55	51	
12:20:00	0:01:00	53.8	61.9	55	47	
12:21:00	0:01:00	55.2	65	60	49	

Table A.6i – Noise Monitoring Data (dBA): Edmonston Drive & Gilbert Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:22:00	0:01:00	52.6	64.1	57	47	
12:23:00	0:01:00	52	61.6	58	45	
12:24:00	0:01:00	59.5	75.8	66	47	Despiked – statistical outlier
12:25:00	0:01:00	49.8	62.3	55	45	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.6j – Noise Monitoring Data (dBA): Woodburn Road & Grandin Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:17:00	0:01:00	56.4	66.8	62	50	
12:18:00	0:01:00	51.8	63.7	56	46	
12:19:00	0:01:00	51.3	56.3	54	46	
12:20:00	0:01:00	49.3	54.4	52	44	
12:21:00	0:01:00	54.7	63.4	58	50	
12:22:00	0:01:00	49.2	55.3	52	46	
12:23:00	0:01:00	50.6	56.6	56	44	
12:24:00	0:01:00	55.8	65	60	52	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.6k – Noise Monitoring Data (dBA): Broadwood Drive & Baltimore Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:40:00	0:01:00	59.2	66.7	64	49	
12:41:00	0:01:00	55.8	66.6	64	44	
12:42:00	0:01:00	60.2	67.9	65	45	
12:43:00	0:01:00	57.8	68.5	63	47	
12:44:00	0:01:00	63.9	77.1	71	50	Despiked – statistical outlier
12:45:00	0:01:00	61.8	75.8	67	49	
12:46:00	0:01:00	57.4	66.3	62	45	
12:47:00	0:01:00	57.9	66.7	63	44	
12:48:00	0:01:00	59.7	66.7	64	50	
12:49:00	0:01:00	59.6	67.5	65	46	
12:50:00	0:01:00	60.2	70.3	64	49	
12:51:00	0:01:00	62.7	70.7	67	51	
12:52:00	0:01:00	60.7	75.4	65	45	
12:53:00	0:01:00	60.1	75.1	66	45	
12:54:00	0:01:00	48.8	63.6	50	45	
12:55:00	0:01:00	63.1	73.3	69	50	Despiked – statistical outlier
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.6l – Noise Monitoring Data (dBA): Broadwood Drive & Bradley Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:40:00	0:01:00	47	59.9	48	44	
12:41:00	0:01:00	46.2	49	48	44	
12:42:00	0:01:00	46.1	50.9	48	44	
12:43:00	0:01:00	54.8	71.7	60	44	
12:44:00	0:01:00	62.4	76.6	68	50	Despiked – statistical outlier

Table A.6l – Noise Monitoring Data (dBA): Broadwood Drive & Bradley Avenue						
Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
12:45:00	0:01:00	56.7	69.6	64	44	
12:46:00	0:01:00	45.2	58.1	48	44	
12:47:00	0:01:00	59.8	72.7	68	46	Despiked – statistical outlier
12:48:00	0:01:00	46.8	57.1	48	44	
12:49:00	0:01:00	53.4	64.4	60	46	
12:50:00	0:01:00	59.6	71.2	66	48	Despiked – statistical outlier
12:51:00	0:01:00	51.1	64.9	56	44	
12:52:00	0:01:00	58.8	72.5	68	44	
12:53:00	0:01:00	52.4	71	54	44	
12:54:00	0:01:00	54.6	66.2	62	46	
12:55:00	0:01:00	47.6	53.4	50	46	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.6m – Noise Monitoring Data (dBA): McAuliffe Drive & Farragut Avenue						
Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
13:05:00	0:01:00	50.6	54.2	52	50	
13:06:00	0:01:00	51.9	58.7	54	50	
13:07:00	0:01:00	53.3	62.3	56	52	
13:08:00	0:01:00	58	74.2	64	50	
13:09:00	0:01:00	56	69.2	62	50	
13:10:00	0:01:00	52.5	60.6	56	50	
13:11:00	0:01:00	59.6	67.8	66	50	
13:12:00	0:01:00	55.2	66.3	60	50	
13:13:00	0:01:00	64	77.9	72	54	Despiked – statistical outlier
13:14:00	0:01:00	56.9	68.6	64	52	
13:15:00	0:01:00	54.7	68.6	58	50	
13:16:00	0:01:00	56	69.4	60	52	
13:17:00	0:01:00	55.9	67.4	62	50	
13:18:00	0:01:00	52.1	56.2	54	50	
13:19:00	0:01:00	58.2	64.1	62	54	
13:20:00	0:01:00	56	63.7	60	52	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.6n – Noise Monitoring Data (dBA): McAuliffe Drive & Twinbrook Parkway						
Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
13:06:00	0:01:00	68.1	77.1	73	57	
13:07:00	0:01:00	55.6	63.9	60	51	
13:08:00	0:01:00	62.8	71	68	51	
13:09:00	0:01:00	66.8	79.5	74	51	
13:10:00	0:01:00	58.1	67	62	51	
13:11:00	0:01:00	67.5	73.3	71	58	
13:12:00	0:01:00	60.8	67.4	64	55	
13:13:00	0:01:00	67.8	79.9	72	54	
13:14:00	0:01:00	62.2	68.5	65	57	
13:15:00	0:01:00	63.3	70.9	69	57	
13:16:00	0:01:00	68.6	70.3	69	67	
13:17:00	0:01:00	69.6	71.9	70	69	
13:18:00	0:01:00	70.6	83.4	77	56	

Table A.6n – Noise Monitoring Data (dBA): McAuliffe Drive & Twinbrook Parkway						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:19:00	0:01:00	61.5	67.9	64	55	
13:20:00	0:01:00	65.4	73.9	69	61	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.6o – Noise Monitoring Data (dBA): Twinbrook Parkway & Marshall Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:30:00	0:01:00	65.9	78.1	69	51	
13:31:00	0:01:00	64.1	69.5	68	59	
13:32:00	0:01:00	65.2	71.9	68	49	
13:33:00	0:01:00	62.1	72.6	67	49	
13:34:00	0:01:00	61.5	69.7	66	49	
13:35:00	0:01:00	61.4	74	67	49	
13:36:00	0:01:00	58.2	69.7	65	58	
13:37:00	0:01:00	64.6	69.5	68	50	
13:38:00	0:01:00	59.7	70.1	66	52	
13:39:00	0:01:00	61.5	68.7	66	58	
13:40:00	0:01:00	66.1	77.2	70	47	
13:41:00	0:01:00	61.1	69.9	67	53	
13:42:00	0:01:00	61.5	69.1	66	52	
13:43:00	0:01:00	61.8	69.2	67	58	
13:44:00	0:01:00	66.3	74.4	69	58	
13:45:00	0:01:00	66.5	75.1	71	51	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.6p – Noise Monitoring Data (dBA): Tweed Street & Marshall Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:30:00	0:01:00	48.6	56.2	50	46	
13:31:00	0:01:00	51.6	67.5	54	46	
13:32:00	0:01:00	52.4	65	58	46	
13:33:00	0:01:00	46.7	51.3	48	44	
13:34:00	0:01:00	46.8	50.1	48	46	
13:35:00	0:01:00	46.7	53.5	48	44	
13:36:00	0:01:00	52	60.1	58	44	
13:37:00	0:01:00	49.6	59	54	46	
13:38:00	0:01:00	46.2	49.8	48	44	
13:39:00	0:01:00	48.5	53.3	50	46	
13:40:00	0:01:00	49.4	57.2	52	46	
13:41:00	0:01:00	47	49.9	50	44	
13:42:00	0:01:00	51.2	53.3	52	48	
13:43:00	0:01:00	54.3	57	56	54	
13:44:00	0:01:00	56.6	62	58	54	
13:45:00	0:01:00	58.4	64.8	62	56	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Figure A.6a: Diurnal $L_{eq(h)}$ Plot – Norbeck Road (Burgundy Estates, Silver Rock, Twinbrook Forest) Study Area

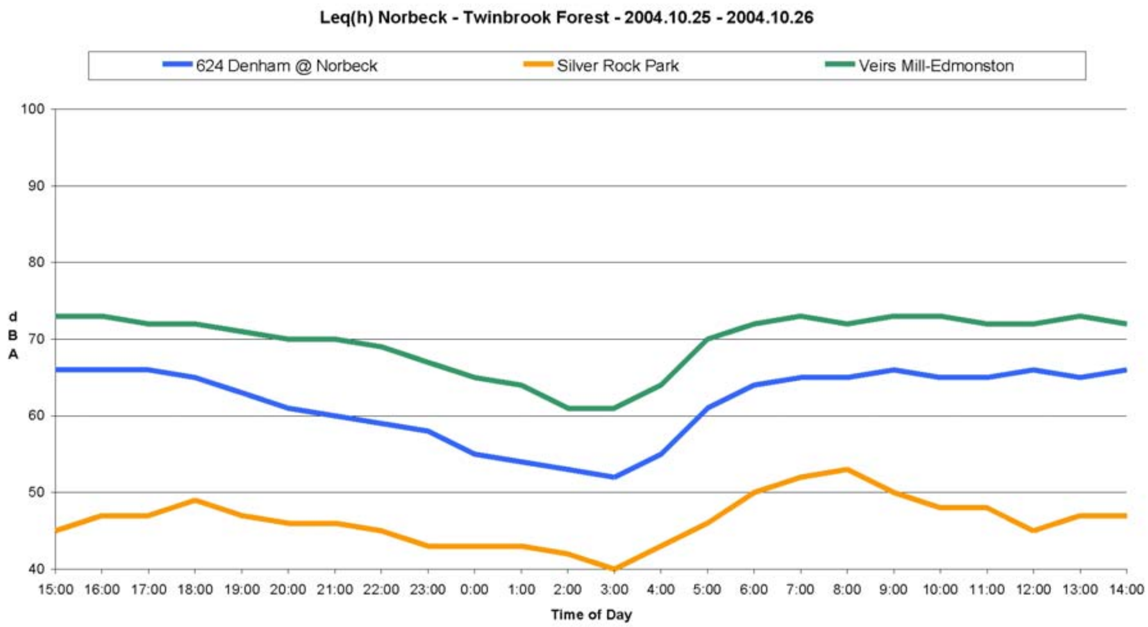
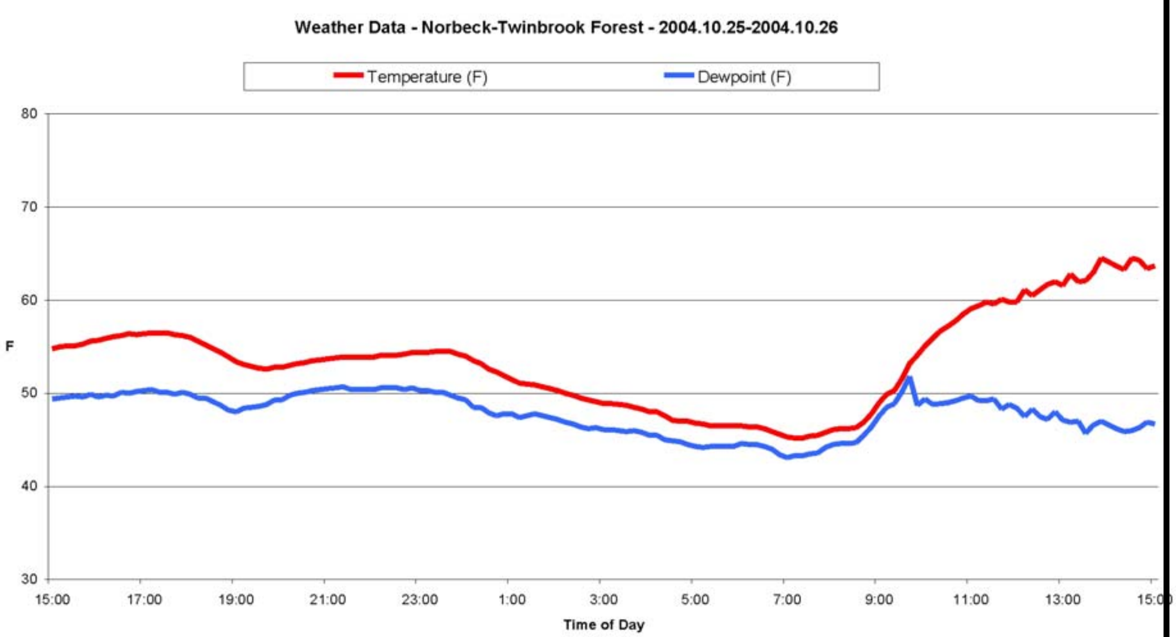


Figure A.6b: Weather Data – Norbeck Road (Burgundy Estates, Silver Rock, Twinbrook Forest) Study Area



A.7 North Farm

Table A.7a – Noise Monitoring Data Summary (dBA): North Farm							
Location	**$L_{eq(h)}$**	**L_{max}**	**L_{10}**	**L_{90}**	**L_{dn}**	**L_{eq24h}**	**Comment**
610 Farm Pond Lane	61	88	65	56	60	55	24-hour
North Farm & Mont	68	82	70	65	70	66	24-hour
N. Farm Pk. Tennis Ct	64	78	67	61	66	62	24-hour
Mont & Farm Haven	75*	89	79*	70*	N/A	N/A	Short-term
1021 Farm Haven	64*	79	68*	57*	N/A	N/A	Short-term
30 Hollyberry	57**	66	61**	54**	N/A	N/A	Short-term
416 Green Pasture	55**	70	59**	51**	N/A	N/A	Short-term
400 Green Pasture	63*	82	66*	60*	N/A	N/A	Short-term
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.							
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at North Farm Lane and Montrose Road.*							
***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 610 Farm Pond Lane*							

Table A.7b – Noise Monitoring Data (dBA): 610 Farm Pond Lane						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:00	1:00:00	54	69	56	52	
14:00	1:00:00	54	68	56	52	
15:00	1:00:00	55	70	57	53	
16:00	1:00:00	56	72	58	54	
17:00	1:00:00	**61**	82	65	56	Loudest-hour $L_{eq(h)}$
18:00	1:00:00	60	88	63	55	
19:00	1:00:00	57	70	58	56	
20:00	1:00:00	56	65	58	55	
21:00	1:00:00	55	65	57	53	
22:00	1:00:00	53	61	55	51	
23:00	1:00:00	52	69	54	50	
0:00	1:00:00	50	59	51	48	
1:00	1:00:00	49	57	51	47	
2:00	1:00:00	48	57	50	47	
3:00	1:00:00	51	58	53	49	
4:00	1:00:00	53	64	55	51	
5:00	1:00:00	55	59	56	53	
6:00	1:00:00	56	65	58	55	
7:00	1:00:00	57	70	58	55	
8:00	1:00:00	57	71	59	55	
9:00	1:00:00	55	74	57	52	
10:00	1:00:00	55	67	57	52	
11:00	1:00:00	54	72	56	51	
12:00	1:00:00	53	61	54	51	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.7c – Noise Monitoring Data (dBA): North Farm Lane & Montrose Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:00	1:00:00	67	77	70	65	
14:00	1:00:00	67	79	69	64	
15:00	1:00:00	68	82	70	65	Loudest-hour $L_{eq(h)}$
16:00	1:00:00	68	79	69	64	Loudest-hour $L_{eq(h)}$
17:00	1:00:00	67	76	69	63	
18:00	1:00:00	68	80	69	61	Loudest-hour $L_{eq(h)}$

Table A.7c – Noise Monitoring Data (dBA): North Farm Lane & Montrose Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
19:00	1:00:00	67	77	67	58	
20:00	1:00:00	67	79	65	56	
21:00	1:00:00	66	79	64	53	
22:00	1:00:00	64	78	62	51	
23:00	1:00:00	62	78	60	49	
0:00	1:00:00	60	78	60	50	
1:00	1:00:00	58	76	64	53	
2:00	1:00:00	56	73	67	58	
3:00	1:00:00	57	74	70	61	
4:00	1:00:00	60	78	70	64	
5:00	1:00:00	64	78	70	65	
6:00	1:00:00	67	77	70	64	
7:00	1:00:00	68	78	70	64	Loudest-hour $L_{eq(h)}$
8:00	1:00:00	68	79	70	64	Loudest-hour $L_{eq(h)}$
9:00	1:00:00	68	80	69	64	Loudest-hour $L_{eq(h)}$
10:00	1:00:00	67	78	70	65	
11:00	1:00:00	67	80	69	64	
12:00	1:00:00	67	78	70	65	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.7d – Noise Monitoring Data (dBA): North Farm Park Tennis Court						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:00	1:00:00	63	72	65	60	
14:00	1:00:00	63	72	65	60	
15:00	1:00:00	63	73	65	61	
16:00	1:00:00	63	72	65	60	
17:00	1:00:00	62	75	64	60	
18:00	1:00:00	63	74	65	61	
19:00	1:00:00	63	74	65	61	
20:00	1:00:00	62	76	64	60	
21:00	1:00:00	61	73	64	58	
22:00	1:00:00	59	73	62	56	
23:00	1:00:00	58	69	60	54	
0:00	1:00:00	55	69	58	52	
1:00	1:00:00	54	70	58	50	
2:00	1:00:00	53	67	56	50	
3:00	1:00:00	54	68	57	51	
4:00	1:00:00	57	74	60	53	
5:00	1:00:00	60	71	63	56	
6:00	1:00:00	62	73	65	59	
7:00	1:00:00	63	74	65	61	
8:00	1:00:00	64	75	66	61	
9:00	1:00:00	63	73	65	60	
10:00	1:00:00	64	78	67	61	Loudest-hour $L_{eq(h)}$
11:00	1:00:00	63	74	65	60	
12:00	1:00:00	62	72	64	60	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.7e – Noise Monitoring Data (dBA): Montrose Road & Farm Haven Drive						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:20:00	0:01:00	70.8	79.5	74	58	
11:21:00	0:01:00	71.2	89.4	80	58	
11:22:00	0:01:00	73.4	84.2	78	66	
11:23:00	0:01:00	72.5	76.6	76	70	
11:24:00	0:01:00	74.7	82.5	78	70	
11:25:00	0:01:00	71.9	77.5	76	66	
11:26:00	0:01:00	77.3	93	84	66	Despiked – statistical outlier
11:27:00	0:01:00	74.7	79.8	78	70	
11:28:00	0:01:00	73.3	77.4	76	68	
11:29:00	0:01:00	73	79.8	76	70	
11:30:00	0:01:00	72.7	79	76	68	
11:31:00	0:01:00	74.4	80.8	78	66	
11:32:00	0:01:00	72.4	78.4	76	64	
11:33:00	0:01:00	72.5	77.7	76	66	
11:34:00	0:01:00	74.5	78.9	78	72	
11:35:00	0:01:00	72.8	77.8	76	68	
11:36:00	0:01:00	72.3	75.9	74	68	
11:37:00	0:01:00	71.8	76.4	74	68	
11:38:00	0:01:00	74.2	80.6	76	70	
11:39:00	0:01:00	73.1	79.4	76	70	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.7f – Noise Monitoring Data (dBA): 1021 Farm Haven Drive						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:20:00	0:01:00	65	75	68	53	
11:21:00	0:01:00	76.4	97.3	83	57	Despiked – statistical outlier
11:22:00	0:01:00	69.5	78.2	75	58	
11:23:00	0:01:00	58.5	62.1	60	56	
11:24:00	0:01:00	60.8	71	65	56	
11:25:00	0:01:00	59.4	66.3	63	54	
11:26:00	0:01:00	64.1	79.4	71	53	
11:27:00	0:01:00	60.6	68.3	62	57	
11:28:00	0:01:00	58.7	63.1	61	54	
11:29:00	0:01:00	59.2	66.2	61	56	
11:30:00	0:01:00	57.9	63.7	59	54	
11:31:00	0:01:00	59.6	65.4	62	53	
11:32:00	0:01:00	59.4	66.6	62	54	
11:33:00	0:01:00	57.2	62.6	60	53	
11:34:00	0:01:00	60.1	66.9	63	56	
11:35:00	0:01:00	57.6	61.4	59	54	
11:36:00	0:01:00	58.2	61.5	60	55	
11:37:00	0:01:00	57.3	62.4	59	53	
11:38:00	0:01:00	59.5	67.4	61	56	
11:39:00	0:01:00	59.4	67.5	62	56	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.7g – Noise Monitoring Data (dBA): 30 Hollyberry Court						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:45:00	0:01:00	54.2	56.8	56	50	
11:46:00	0:01:00	56.6	63	60	52	
11:47:00	0:01:00	55.4	58.6	58	54	
11:48:00	0:01:00	56	62.8	60	50	
11:49:00	0:01:00	66.1	74	72	58	Despiked – statistical outlier
11:50:00	0:01:00	57.3	66.2	60	54	
11:51:00	0:01:00	55.4	58.2	56	54	
11:52:00	0:01:00	55.7	62.2	60	50	
11:53:00	0:01:00	55.5	57.8	56	54	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.7h – Noise Monitoring Data (dBA): 416 Green Pasture Drive						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:05:00	0:01:00	59.3	62.3	61	56	
12:06:00	0:01:00	65.3	82	72	51	Despiked – statistical outlier
12:07:00	0:01:00	65	84.5	70	47	Despiked – statistical outlier
12:08:00	0:01:00	51.3	64.5	55	47	
12:09:00	0:01:00	47.3	47.8	47	47	
12:10:00	0:01:00	47	47.5	47	46	
12:11:00	0:01:00	50.6	61.3	54	47	
12:12:00	0:01:00	55.7	69.5	62	47	
12:13:00	0:01:00	48	49.1	48	47	
12:14:00	0:01:00	53.4	68.1	59	47	
12:15:00	0:01:00	48.2	50.3	49	46	
12:16:00	0:01:00	53.1	68.6	58	46	
12:17:00	0:01:00	46.8	48.7	47	46	
12:18:00	0:01:00	53.2	68	59	47	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.7i – Noise Monitoring Data (dBA): 400 Green Pasture Drive						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:05:00	0:01:00	59.7	63	62	58	
12:06:00	0:01:00	62.4	80.2	68	52	
12:07:00	0:01:00	76.9	100.6	76	56	Despiked – statistical outlier
12:08:00	0:01:00	63.2	81.8	66	56	
12:09:00	0:01:00	59.6	62.9	62	58	
12:10:00	0:01:00	58.9	63.4	62	56	
12:11:00	0:01:00	59.5	68.2	62	56	
12:12:00	0:01:00	62.1	71.8	64	58	
12:13:00	0:01:00	61.7	66.4	64	60	
12:14:00	0:01:00	60	66.7	62	58	
12:15:00	0:01:00	62.2	67.3	64	60	
12:16:00	0:01:00	59	61.8	60	56	
12:17:00	0:01:00	62.1	71.4	66	60	
12:18:00	0:01:00	60.6	67.4	62	56	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Figure A.7a: Diurnal $L_{eq(h)}$ Plot – North Farm Study Area

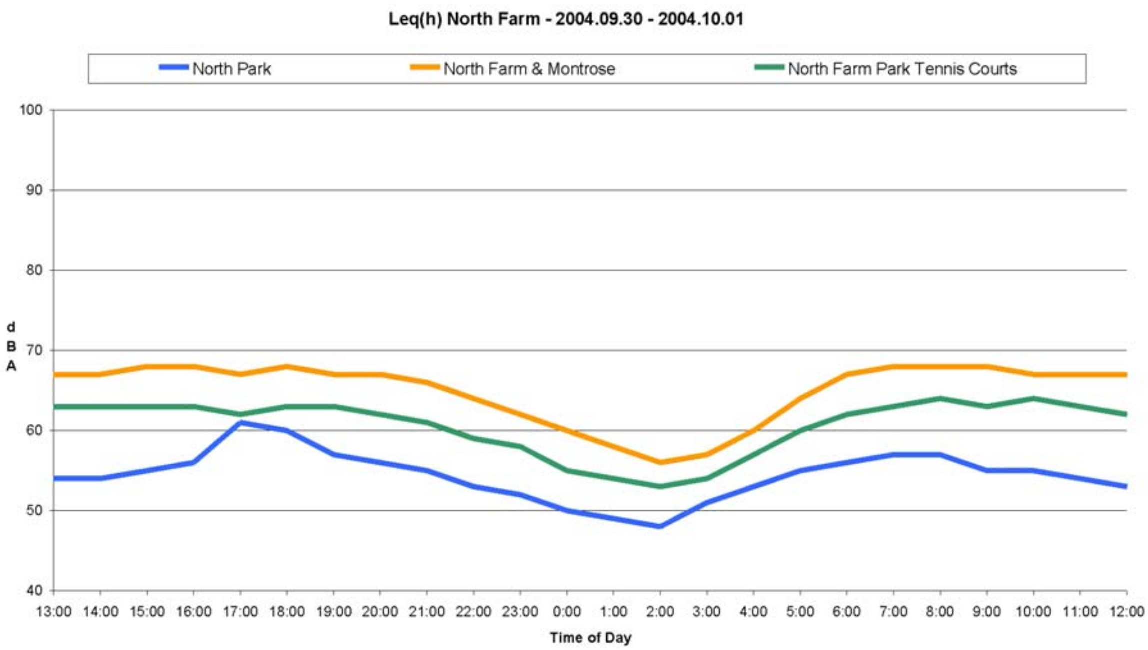
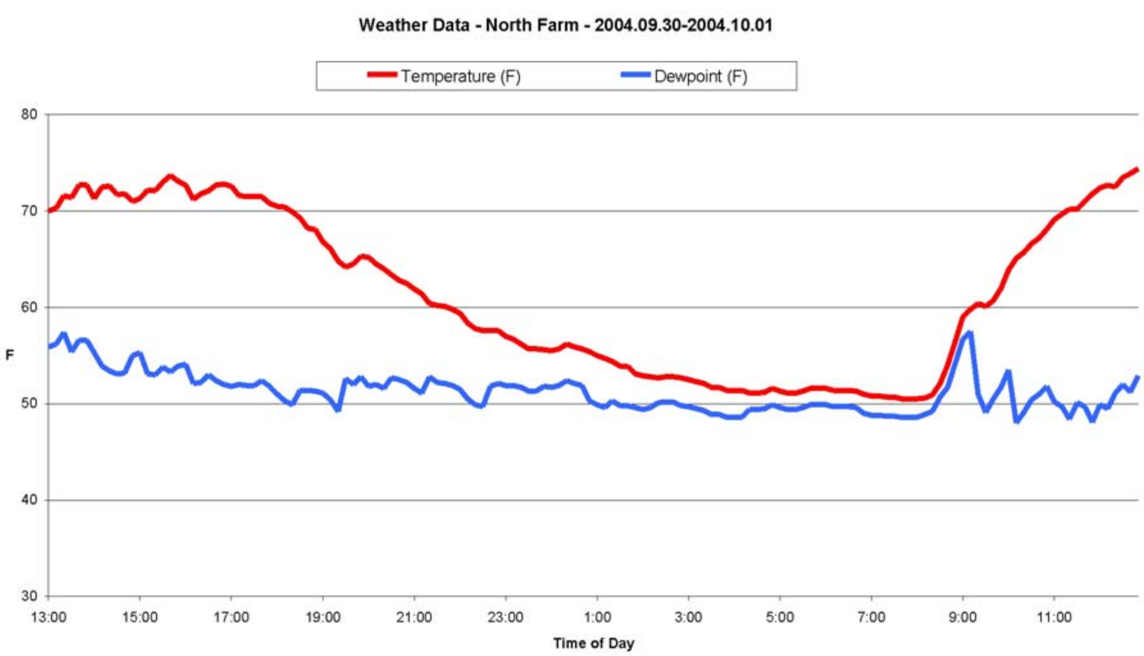


Figure A.7b: Weather Data – North Farm Study Area



A.8 North Stonestreet Avenue – Frederick Avenue (Lincoln Park)

Table A.8a – Noise Monitoring Data Summary (dBA): North Stonestreet Avenue – Frederick Avenue (Lincoln Park)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
Frederick Ave – end	84	112	87	77	85	78	24-hour
112 Frederick Ave	66	88	69	59	68	61	24-hour
N Stonestreet & Ashley	61	78	64	58	62	56	24-hour
916 N Stonestreet+100	60*	68	62*	58*	N/A	N/A	Short-term
916 N Stonestreet+200	63**	69	66**	60**	N/A	N/A	Short-term
610 Douglas Ave	57	76	61	50	N/A	N/A	Short-term
Douglas & Spring	53	70	58	48	N/A	N/A	Short-term

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at North Stonestreet Avenue and Ashley Avenue.*
***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at the west end of Frederick Avenue.*

Table A.8b – Noise Monitoring Data (dBA): Frederick Avenue @ CSX / Metro ROW

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
9:00	1:00:00	69	89	74	55	
10:00	1:00:00	79	99	83	74	
11:00	1:00:00	74	101	76	55	
12:00	1:00:00	70	95	75	55	
13:00	1:00:00	84	104	87	77	Loudest-hour $L_{eq(h)}$
14:00	1:00:00	81	107	85	72	
15:00	1:00:00	73	97	77	54	
16:00	1:00:00	72	96	77	57	
17:00	1:00:00	72	94	77	54	
18:00	1:00:00	80	104	83	71	
19:00	1:00:00	71	90	76	49	
20:00	1:00:00	76	97	79	69	
21:00	1:00:00	79	101	83	73	
22:00	1:00:00	82	106	87	52	
23:00	1:00:00	63	86	66	48	
0:00	1:00:00	82	106	86	72	
1:00	1:00:00	79	106	82	69	
2:00	1:00:00	75	98	78	68	
3:00	1:00:00	74	95	77	69	
4:00	1:00:00	83	105	87	72	
5:00	1:00:00	65	91	70	49	
6:00	1:00:00	71	94	75	50	
7:00	1:00:00	83	112	85	71	
8:00	1:00:00	70	91	74	57	

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.

Table A.8c – Noise Monitoring Data (dBA): 112 Frederick Avenue

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
9:00	1:00:00	58	85	62	48	
10:00	1:00:00	62	82	66	57	
11:00	1:00:00	59	82	63	48	
12:00	1:00:00	61	78	65	55	
13:00	1:00:00	65	85	68	59	
14:00	1:00:00	63	87	67	56	

Table A.8c – Noise Monitoring Data (dBA): 112 Frederick Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
15:00	1:00:00	63	83	68	51	
16:00	1:00:00	60	77	65	51	
17:00	1:00:00	59	78	63	50	
18:00	1:00:00	64	85	68	57	
19:00	1:00:00	58	77	63	47	
20:00	1:00:00	60	78	64	54	
21:00	1:00:00	62	83	66	56	
22:00	1:00:00	63	87	67	48	
23:00	1:00:00	55	76	59	47	
0:00	1:00:00	66	88	69	58	Loudest-hour $L_{eq(h)}$
1:00	1:00:00	62	88	64	50	
2:00	1:00:00	57	78	60	50	
3:00	1:00:00	58	77	61	53	
4:00	1:00:00	63	85	66	57	
5:00	1:00:00	54	73	59	48	
6:00	1:00:00	57	76	62	47	
7:00	1:00:00	60	77	64	53	
8:00	1:00:00	60	80	64	55	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.8d – Noise Monitoring Data (dBA): North Stonestreet Avenue & Ashley Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
9:00	1:00:00	57	76	61	53	
10:00	1:00:00	56	74	59	53	
11:00	1:00:00	56	76	60	51	
12:00	1:00:00	55	76	59	50	
13:00	1:00:00	55	72	59	51	
14:00	1:00:00	56	73	60	50	
15:00	1:00:00	56	76	60	50	
16:00	1:00:00	56	77	60	50	
17:00	1:00:00	57	76	60	52	
18:00	1:00:00	56	69	59	52	
19:00	1:00:00	55	73	59	50	
20:00	1:00:00	52	68	55	49	
21:00	1:00:00	50	68	53	47	
22:00	1:00:00	55	74	59	49	
23:00	1:00:00	57	78	60	51	
0:00	1:00:00	53	69	55	49	Loudest-hour $L_{eq(h)}$
1:00	1:00:00	56	74	59	51	
2:00	1:00:00	55	73	58	51	
3:00	1:00:00	50	71	53	47	
4:00	1:00:00	54	74	57	49	
5:00	1:00:00	56	76	59	53	
6:00	1:00:00	57	78	60	54	
7:00	1:00:00	61	74	64	58	
8:00	1:00:00	57	73	60	53	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.8e – Noise Monitoring Data (dBA): 916 North Stonestreet Avenue – 100' West of Pavement						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
10:35:00	0:01:00	54.8	56.3	56	54	
10:36:00	0:01:00	53.3	55.7	56	52	
10:37:00	0:01:00	58.2	62.1	60	56	
10:38:00	0:01:00	58.3	68.4	64	54	Despiked – statistical outlier
10:39:00	0:01:00	56.6	62.6	60	54	
10:40:00	0:01:00	53.4	56.5	56	52	
10:41:00	0:01:00	55.4	57.5	56	54	
10:42:00	0:01:00	53.1	56.3	54	52	
10:43:00	0:01:00	54.5	57.7	58	52	
10:44:00	0:01:00	57.5	68.2	58	56	
10:45:00	0:01:00	54	56.9	56	52	
10:46:00	0:01:00	53.7	55.4	54	52	
10:47:00	0:01:00	52.9	55.7	54	52	
10:48:00	0:01:00	54.6	57.1	56	52	
10:49:00	0:01:00	52.5	55	54	52	
10:50:00	0:01:00	58.6	66.1	64	54	Despiked – statistical outlier
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.8f – Noise Monitoring Data (dBA): 916 North Stonestreet Avenue – 200' West of Pavement						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
10:35:00	0:01:00	58	59.5	58	56	
10:36:00	0:01:00	54.7	58.5	57	51	
10:37:00	0:01:00	60.9	68.3	63	57	
10:38:00	0:01:00	62.8	75.3	69	54	Despiked – statistical outlier
10:39:00	0:01:00	61.2	69.2	66	56	
10:40:00	0:01:00	56.2	60.1	59	54	
10:41:00	0:01:00	58.1	61.8	60	56	
10:42:00	0:01:00	56.8	60.7	59	53	
10:43:00	0:01:00	57.3	61.4	60	53	
10:44:00	0:01:00	58.7	60.7	60	56	
10:45:00	0:01:00	57	60.5	59	53	
10:46:00	0:01:00	57.9	60.7	59	55	
10:47:00	0:01:00	55.8	60.8	59	53	
10:48:00	0:01:00	58.5	61.9	60	56	
10:49:00	0:01:00	55.7	59.8	58	53	
10:50:00	0:01:00	63.5	74	69	56	Despiked – statistical outlier
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.8g – Noise Monitoring Data (dBA): 610 Douglas Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:05:00	0:01:00	69.5	91.1	77	46	Despiked – statistical outlier
11:06:00	0:01:00	66.8	75.6	70	59	
11:07:00	0:01:00	68.8	84.2	73	47	Despiked – statistical outlier
11:08:00	0:01:00	59.4	71	67	48	
11:09:00	0:01:00	46.9	49.5	47	46	
11:10:00	0:01:00	49.2	53	51	47	

Table A.8g – Noise Monitoring Data (dBA): 610 Douglas Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:11:00	0:01:00	48.7	52.7	50	47	
11:12:00	0:01:00	55.2	72.5	60	47	
11:13:00	0:01:00	49.4	59.8	50	47	
11:14:00	0:01:00	50.6	58.3	53	47	
11:15:00	0:01:00	48.8	53.8	50	47	
11:16:00	0:01:00	57.3	73.2	64	46	
11:17:00	0:01:00	48.2	57.5	52	45	
11:18:00	0:01:00	47	48.8	48	46	
11:19:00	0:01:00	46	47.5	46	45	
11:20:00	0:01:00	48.6	55.3	50	47	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.8h – Noise Monitoring Data (dBA): Douglas Avenue & Spring Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:05:00	0:01:00	67	81.7	74	52	Despiked – statistical outlier
11:06:00	0:01:00	50.7	60.6	52	48	
11:07:00	0:01:00	52.3	62.5	56	48	
11:08:00	0:01:00	59.1	69.6	66	48	
11:09:00	0:01:00	49.7	59.3	50	48	
11:10:00	0:01:00	51.2	57.3	54	50	
11:11:00	0:01:00	51.4	56.1	54	48	
11:12:00	0:01:00	57.2	73.1	60	50	Despiked – statistical outlier
11:13:00	0:01:00	51.8	56.9	56	50	
11:14:00	0:01:00	57.2	70.3	62	50	
11:15:00	0:01:00	53.4	59.8	56	48	
11:16:00	0:01:00	58.8	74.3	66	48	Despiked – statistical outlier
11:17:00	0:01:00	50.6	60.9	56	46	
11:18:00	0:01:00	48.3	53.1	50	46	
11:19:00	0:01:00	46.3	47.8	48	46	
11:20:00	0:01:00	68.3	86.1	76	48	Despiked – statistical outlier
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Figure A.8a: Diurnal $L_{eq(h)}$ Plot – North Stonestreet Avenue – Frederick Avenue (Lincoln Park) Study Area

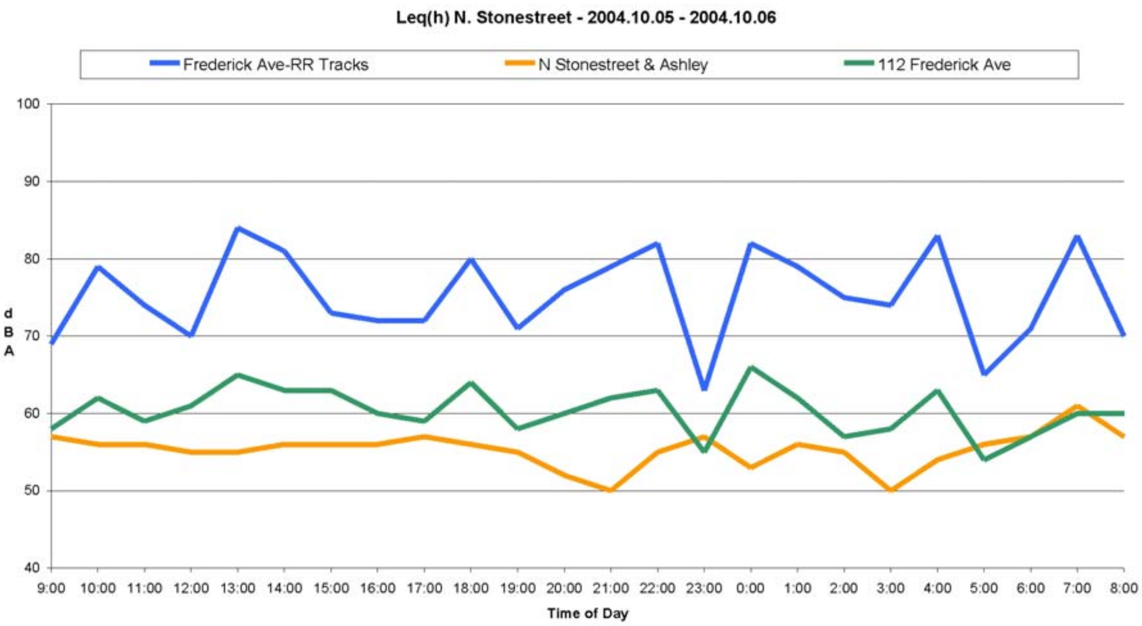
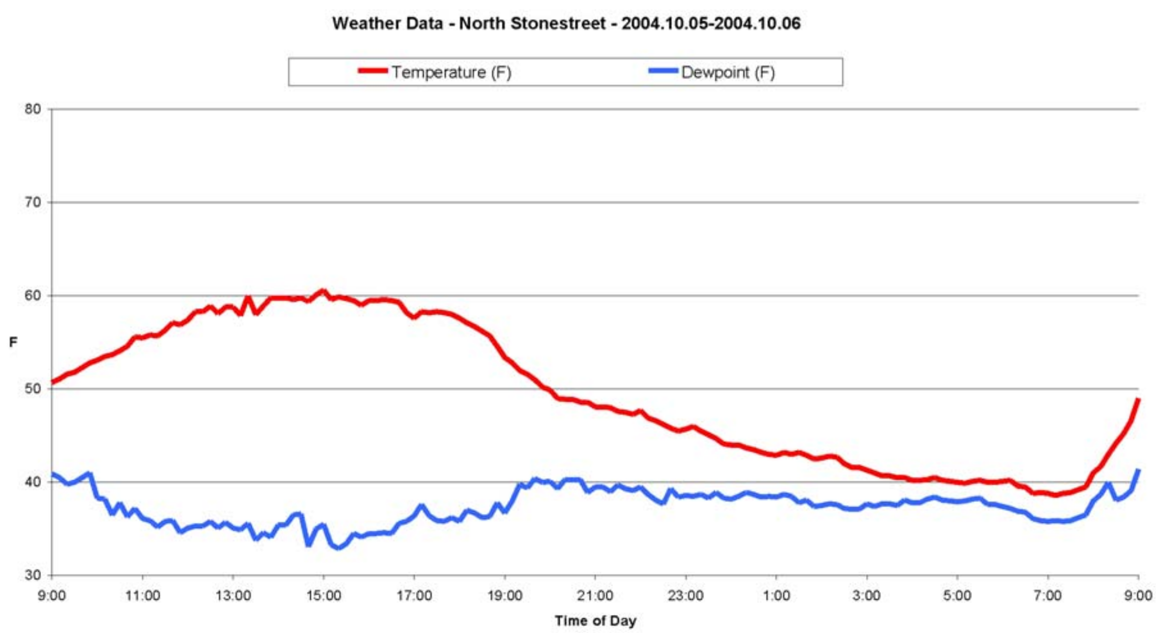


Figure A.8b: Weather Data – North Stonestreet Avenue – Frederick Avenue (Lincoln Park) Study Area



A.9 Twinbrook (Rockcrest Courts, NW Twinbrook)

Table A.9a – Noise Monitoring Data Summary (dBA): Twinbrook (Rockcrest Courts, NW Twinbrook)							
Location	**$L_{eq(h)}$**	**L_{max}**	**L_{10}**	**L_{90}**	**L_{dn}**	**L_{eq24h}**	**Comment**
Lewis & Gail	59	82	64	55	63	57	24-hour
Veirs Mill & Gail	81	100	85	70	78	75	24-hour
Rockcrest & RR Tracks	83	115	83	71	80	75	24-hour
Hillcrest Park	59*	70	62*	56*	N/A	N/A	Short-term
1010 Paul Street	53*	59	53*	52*	N/A	N/A	Short-term
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.							
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Lewis Avenue and Gail Avenue.*							

Table A.9b – Noise Monitoring Data (dBA): Lewis Avenue & Gail Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:00	1:00:00	56	78	60	49	
13:00	1:00:00	58	79	61	51	
14:00	1:00:00	55	75	60	49	
15:00	1:00:00	59	80	64	50	Loudest-hour $L_{eq(h)}$
16:00	1:00:00	57	76	62	48	
17:00	1:00:00	57	74	62	49	
18:00	1:00:00	57	76	61	50	
19:00	1:00:00	58	75	62	52	
20:00	1:00:00	57	75	60	53	
21:00	1:00:00	57	74	60	54	
22:00	1:00:00	58	79	61	55	
23:00	1:00:00	57	74	62	52	
0:00	1:00:00	54	68	56	52	
1:00	1:00:00	58	78	61	54	
2:00	1:00:00	58	82	62	52	
3:00	1:00:00	57	76	59	53	
4:00	1:00:00	49	64	51	47	
5:00	1:00:00	52	72	56	48	
6:00	1:00:00	55	74	60	49	
7:00	1:00:00	56	76	60	49	
8:00	1:00:00	56	74	61	50	
9:00	1:00:00	58	82	63	51	
10:00	1:00:00	57	75	61	52	
11:00	1:00:00	55	80	59	49	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.9c – Noise Monitoring Data (dBA): Veirs Mill Road & Gail Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:00	1:00:00	76	94	80	65	
13:00	1:00:00	75	90	79	63	
14:00	1:00:00	76	92	79	62	
15:00	1:00:00	76	94	80	65	
16:00	1:00:00	76	98	79	67	
17:00	1:00:00	75	90	79	65	
18:00	1:00:00	75	92	79	64	
19:00	1:00:00	75	94	78	63	

Table A.9c – Noise Monitoring Data (dBA): Veirs Mill Road & Gail Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
20:00	1:00:00	74	89	78	63	
21:00	1:00:00	74	93	78	63	
22:00	1:00:00	72	91	77	60	
23:00	1:00:00	71	86	75	59	
0:00	1:00:00	71	101	73	56	
1:00	1:00:00	66	85	70	54	
2:00	1:00:00	63	82	67	53	
3:00	1:00:00	64	88	68	51	
4:00	1:00:00	66	93	69	50	
5:00	1:00:00	71	90	75	56	
6:00	1:00:00	75	90	79	63	
7:00	1:00:00	77	93	81	66	
8:00	1:00:00	77	93	80	66	
9:00	1:00:00	81	100	85	70	Loudest-hour $L_{eq(h)}$
10:00	1:00:00	77	93	80	64	
11:00	1:00:00	76	95	79	64	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.9d – Noise Monitoring Data (dBA): Rockcrest Circle & CSX / Metro ROW						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:00	1:00:00	59	81	65	50	
13:00	1:00:00	79	103	81	68	
14:00	1:00:00	62	85	68	50	
15:00	1:00:00	72	96	77	50	
16:00	1:00:00	70	96	73	49	
17:00	1:00:00	67	94	73	50	
18:00	1:00:00	69	93	74	51	
19:00	1:00:00	83	115	83	62	Loudest-hour $L_{eq(h)}$
20:00	1:00:00	79	100	83	71	
21:00	1:00:00	78	100	82	68	
22:00	1:00:00	74	97	76	68	
23:00	1:00:00	75	97	78	59	
0:00	1:00:00	72	98	74	65	
1:00	1:00:00	76	97	79	69	
2:00	1:00:00	77	98	81	67	
3:00	1:00:00	75	98	78	60	
4:00	1:00:00	63	82	64	62	
5:00	1:00:00	66	91	70	63	
6:00	1:00:00	68	91	72	59	
7:00	1:00:00	70	93	75	53	
8:00	1:00:00	74	96	78	60	
9:00	1:00:00	71	93	76	61	
10:00	1:00:00	73	98	77	67	
11:00	1:00:00	64	84	69	57	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.9e – Noise Monitoring Data (dBA): Hillcrest Park						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:04:00	0:01:00	55.7	72.3	56	48	Despiked – statistical outlier
11:05:00	0:01:00	52.1	55.7	54	48	
11:06:00	0:01:00	51.9	54.2	54	50	
11:07:00	0:01:00	54.9	56.6	56	52	
11:08:00	0:01:00	51.3	53.4	52	50	
11:09:00	0:01:00	54.9	57	56	52	
11:10:00	0:01:00	53.9	58.2	58	50	
11:11:00	0:01:00	54.8	57.3	56	54	
11:12:00	0:01:00	53.4	56.9	56	50	
11:13:00	0:01:00	55.3	64.1	60	52	
11:14:00	0:01:00	54.2	56.8	56	50	
11:15:00	0:01:00	56.6	63	60	52	
11:16:00	0:01:00	55.4	58.6	58	54	
11:17:00	0:01:00	56	62.8	60	50	
11:18:00	0:01:00	66.1	74	72	58	Despiked – statistical outlier
11:19:00	0:01:00	57.3	66.2	60	54	
11:20:00	0:01:00	55.4	58.2	56	54	
11:21:00	0:01:00	55.7	62.2	60	50	
11:22:00	0:01:00	55.5	57.8	56	54	
11:23:00	0:01:00	54.4	57.1	56	50	
11:24:00	0:01:00	54.2	57.2	56	54	
11:25:00	0:01:00	55.5	59.2	58	52	
11:26:00	0:01:00	52.7	54.9	54	50	
11:27:00	0:01:00	56.5	60	58	54	
11:28:00	0:01:00	53	55.2	54	52	
11:29:00	0:01:00	56.4	59	58	54	
11:30:00	0:01:00	54.5	57.4	56	54	
11:31:00	0:01:00	54.5	56.9	56	52	
11:32:00	0:01:00	52.9	56.2	56	50	
11:33:00	0:01:00	55.5	58.2	58	52	
11:34:00	0:01:00	56.1	60.2	58	54	
11:35:00	0:01:00	58.4	63.4	62	54	
11:36:00	0:01:00	59	68.3	62	52	
11:37:00	0:01:00	58.9	69.6	64	50	
11:38:00	0:01:00	59	65.8	64	54	
11:39:00	0:01:00	52.2	56.6	54	50	
11:40:00	0:01:00	55	56.9	56	54	
11:41:00	0:01:00	53.2	55.4	56	50	
11:42:00	0:01:00	55	57.4	56	52	
11:43:00	0:01:00	51.5	54.5	54	48	
11:44:00	0:01:00	54.8	57.6	56	52	
11:45:00	0:01:00	55.5	61.3	60	50	
11:46:00	0:01:00	54	55.8	56	52	
11:47:00	0:01:00	54.3	56.7	56	50	
11:48:00	0:01:00	52	55	54	50	
11:49:00	0:01:00	52.5	55.6	54	50	
11:50:00	0:01:00	51.7	54.5	54	50	
11:51:00	0:01:00	55.9	58.3	58	52	
11:52:00	0:01:00	54.3	58.1	56	52	
11:53:00	0:01:00	54.2	57.3	56	50	
11:54:00	0:01:00	51.9	53.9	54	50	
11:55:00	0:01:00	52.9	55.1	54	50	
11:56:00	0:01:00	52.7	57	56	48	
11:57:00	0:01:00	54.6	58.2	58	50	

Table A.9e – Noise Monitoring Data (dBA): Hillcrest Park						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:58:00	0:01:00	53.2	61	56	50	
11:59:00	0:01:00	54.6	59.3	58	50	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.9f – Noise Monitoring Data (dBA): 1010 Paul Street						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:41:00	0:01:00	49.9	55.5	51	48	
11:42:00	0:01:00	48.5	50.6	49	47	
11:43:00	0:01:00	49.2	53.3	49	48	
11:44:00	0:01:00	51.2	58.5	54	49	
11:45:00	0:01:00	53.2	68.2	56	48	Despiked – statistical outlier
11:46:00	0:01:00	48.8	50.5	49	48	
11:47:00	0:01:00	49.3	51.3	50	48	
11:48:00	0:01:00	48.2	51.1	49	47	
11:49:00	0:01:00	48.2	50.2	49	47	
11:50:00	0:01:00	48.4	51.4	50	47	
11:51:00	0:01:00	48	49.1	48	47	
11:52:00	0:01:00	48.6	51.9	50	47	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Figure A.9a: Diurnal $L_{eq(h)}$ Plot – Twinbrook
(Rockcrest Courts, NW Twinbrook) Study Area

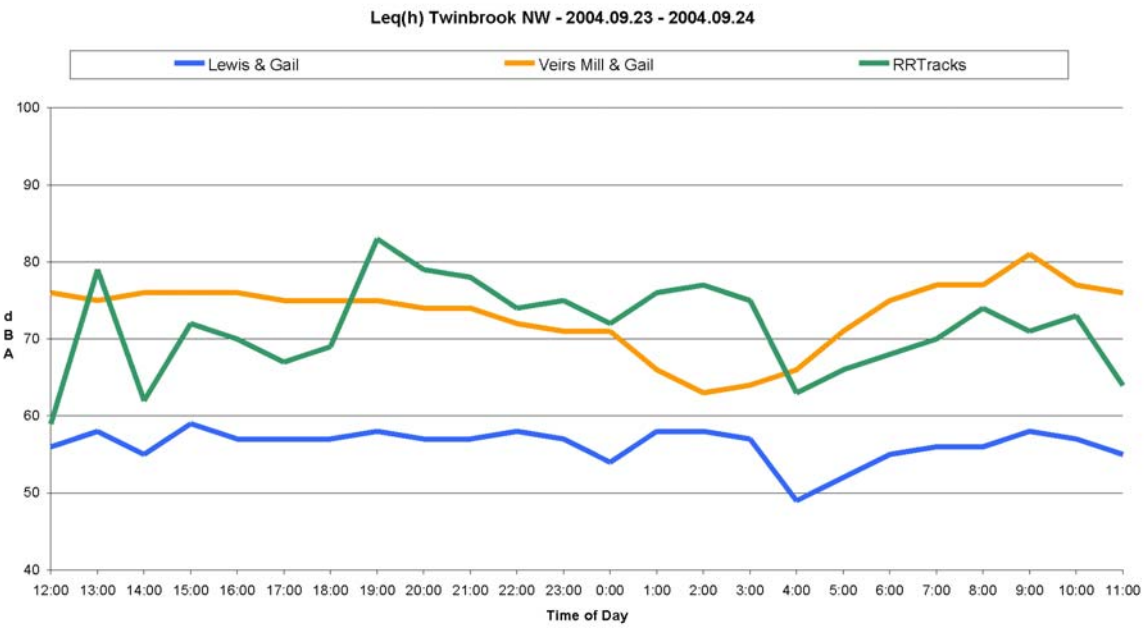
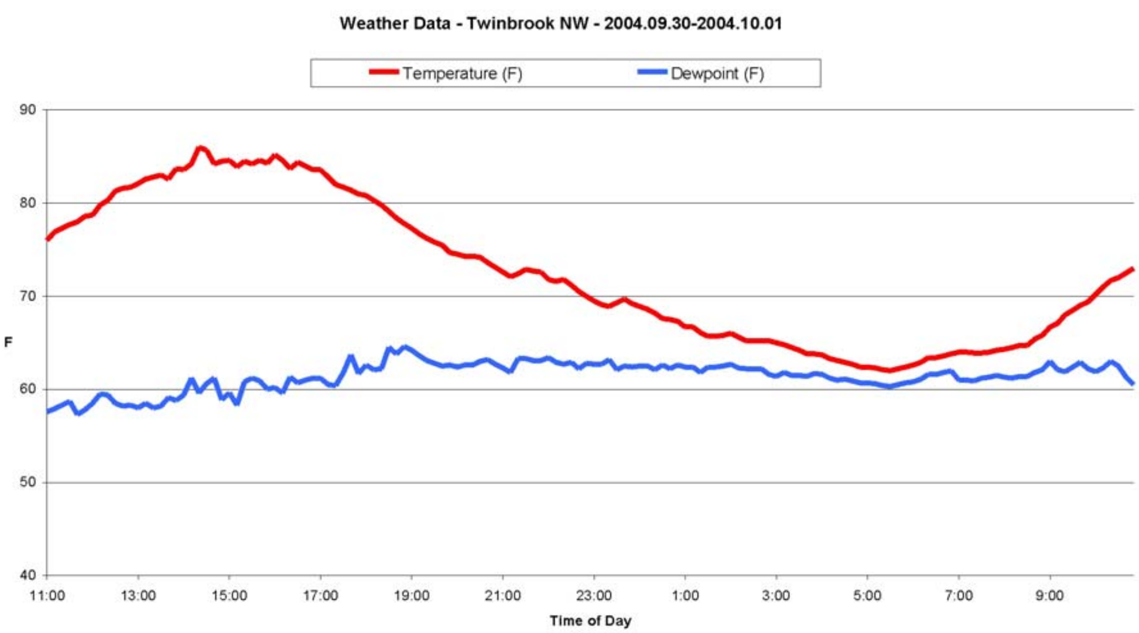


Figure A.9b: Weather Data – Twinbrook
(Rockcrest Courts, NW Twinbrook) Study Area



A.10 Twinbrook (SE Twinbrook)

Table A.10a – Noise Monitoring Data Summary (dBA): Twinbrook (SE Twinbrook)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
1627 Lewis Avenue	64	90	69	56	65	61	24-hour
Twinbrook Park	58	74	59	57	63	56	24-hour
Halpine & Lewis	83	115	83	71	80	75	24-hour
Veirs Mill & Okinawa	77*	85	81*	70*	N/A	N/A	Short-term
St Lo & Okinawa	53*	56	54*	52*	N/A	N/A	Short-term
Rockland & Matthews	53**	68	56**	50**	N/A	N/A	Short-term
Rockland & Ridgeway	52**	67	55**	50**	N/A	N/A	Short-term

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at Veirs Mill Road and Okinawa Avenue.*
***Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 1627 Lewis Avenue.*

Table A.10b – Noise Monitoring Data (dBA): 1627 Lewis Avenue

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
12:00	1:00:00	63	87	67	52	
13:00	1:00:00	62	87	66	51	
14:00	1:00:00	62	81	67	52	
15:00	1:00:00	64	86	69	54	Loudest-hour $L_{eq(h)}$
16:00	1:00:00	60	77	64	50	
17:00	1:00:00	60	77	64	50	
18:00	1:00:00	63	88	65	52	
19:00	1:00:00	62	80	66	56	
20:00	1:00:00	59	85	63	52	
21:00	1:00:00	61	79	65	54	
22:00	1:00:00	57	73	60	52	
23:00	1:00:00	58	76	61	53	
0:00	1:00:00	60	90	63	52	
1:00	1:00:00	58	81	61	55	
2:00	1:00:00	55	68	56	54	
3:00	1:00:00	55	64	56	55	
4:00	1:00:00	58	82	62	54	
5:00	1:00:00	61	84	66	54	
6:00	1:00:00	59	83	63	49	
7:00	1:00:00	61	82	65	51	
8:00	1:00:00	64	90	67	52	
9:00	1:00:00	63	86	68	51	
10:00	1:00:00	59	79	63	51	
11:00	1:00:00	56	72	61	50	

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.

Table A.10c – Noise Monitoring Data (dBA): Twinbrook Park

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
12:00	1:00:00	55	64	57	52	
13:00	1:00:00	56	73	59	52	
14:00	1:00:00	55	70	58	52	
15:00	1:00:00	56	65	57	53	
16:00	1:00:00	55	67	57	52	
17:00	1:00:00	55	66	56	52	
18:00	1:00:00	56	68	58	54	

Table A.10c – Noise Monitoring Data (dBA): Twinbrook Park						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
19:00	1:00:00	57	65	58	56	
20:00	1:00:00	58	72	59	56	Loudest-hour $L_{eq(h)}$
21:00	1:00:00	58	64	59	57	Loudest-hour $L_{eq(h)}$
22:00	1:00:00	57	64	58	56	
23:00	1:00:00	56	64	57	56	
0:00	1:00:00	56	64	57	56	
1:00	1:00:00	56	61	57	56	
2:00	1:00:00	56	62	56	56	
3:00	1:00:00	56	70	58	56	
4:00	1:00:00	56	59	57	56	
5:00	1:00:00	57	62	58	56	
6:00	1:00:00	56	63	58	55	
7:00	1:00:00	56	64	58	54	
8:00	1:00:00	56	63	58	54	
9:00	1:00:00	56	70	58	53	
10:00	1:00:00	56	66	58	52	
11:00	1:00:00	55	68	57	52	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.10d – Noise Monitoring Data (dBA): Halpine Road & Lewis Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:00	1:00:00	59	81	65	50	
13:00	1:00:00	79	103	81	68	
14:00	1:00:00	62	85	68	50	
15:00	1:00:00	72	96	77	50	
16:00	1:00:00	70	96	73	49	
17:00	1:00:00	67	94	73	50	
18:00	1:00:00	69	93	74	51	
19:00	1:00:00	83	115	83	62	Loudest-hour $L_{eq(h)}$
20:00	1:00:00	79	100	83	71	
21:00	1:00:00	78	100	82	68	
22:00	1:00:00	74	97	76	68	
23:00	1:00:00	75	97	78	59	
0:00	1:00:00	72	98	74	65	
1:00	1:00:00	76	97	79	69	
2:00	1:00:00	77	98	81	67	
3:00	1:00:00	75	98	78	60	
4:00	1:00:00	63	82	64	62	
5:00	1:00:00	66	91	70	63	
6:00	1:00:00	68	91	72	59	
7:00	1:00:00	70	93	75	53	
8:00	1:00:00	74	96	78	60	
9:00	1:00:00	71	93	76	61	
10:00	1:00:00	73	98	77	67	
11:00	1:00:00	64	84	69	57	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.10e – Noise Monitoring Data (dBA): Veirs Mill Road & Okinawa Avenue						
Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
11:10:00	0:01:00	74.3	83.2	80	63	
11:11:00	0:01:00	75	84.4	79	65	
11:12:00	0:01:00	71.8	79.4	77	61	
11:13:00	0:01:00	73.9	80.6	78	65	
11:14:00	0:01:00	70.3	81.1	74	65	
11:15:00	0:01:00	78.2	85.2	79	75	
11:16:00	0:01:00	74.8	80.8	78	69	
11:17:00	0:01:00	76.6	83.1	80	69	
11:18:00	0:01:00	72.6	80.2	75	69	
11:19:00	0:01:00	66.2	74.3	70	54	
11:20:00	0:01:00	76.1	83.1	79	66	
11:21:00	0:01:00	70.9	77.9	76	61	
11:22:00	0:01:00	75.6	80.8	79	66	
11:23:00	0:01:00	68.7	79.2	75	52	
11:24:00	0:01:00	73.9	79.8	77	68	
11:25:00	0:01:00	70.5	79	76	57	
11:26:00	0:01:00	74.2	81.8	79	66	
11:27:00	0:01:00	71.4	79.5	78	58	
11:28:00	0:01:00	76.7	83.1	79	69	
11:29:00	0:01:00	70	79.5	77	57	
11:30:00	0:01:00	73.6	79.8	78	61	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.10f – Noise Monitoring Data (dBA): Okinawa Avenue St Lo Avenue						
Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
11:10:00	0:01:00	50.3	55.4	52	48	
11:11:00	0:01:00	48.5	50.6	50	48	
11:12:00	0:01:00	48.2	50.6	50	48	
11:13:00	0:01:00	47.8	48.6	48	48	
11:14:00	0:01:00	49.3	53.4	52	48	
11:15:00	0:01:00	51.3	53.4	52	50	
11:16:00	0:01:00	50.4	52.5	52	50	
11:17:00	0:01:00	50.5	52.6	52	50	
11:18:00	0:01:00	49.9	52.2	50	50	
11:19:00	0:01:00	48.2	49.8	48	48	
11:20:00	0:01:00	49.6	51.3	50	50	
11:21:00	0:01:00	49.9	55.7	52	48	
11:22:00	0:01:00	50.8	53.8	52	50	
11:23:00	0:01:00	50.6	53.9	52	50	
11:24:00	0:01:00	50.2	51.3	50	50	
11:25:00	0:01:00	49.1	49.9	50	48	
11:26:00	0:01:00	48.8	51.8	50	48	
11:27:00	0:01:00	48	51.1	50	46	
11:28:00	0:01:00	48.9	53	50	48	
11:29:00	0:01:00	47.4	49.3	48	46	
11:30:00	0:01:00	48.2	50.2	50	48	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.10g – Noise Monitoring Data (dBA): Rockland Avenue & Matthews Drive						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:40:00	0:01:00	47.2	48.6	47	46	
11:41:00	0:01:00	47.9	49.8	48	47	
11:42:00	0:01:00	52.6	68.4	58	47	
11:43:00	0:01:00	49.6	61.4	55	46	
11:44:00	0:01:00	49.1	58.2	49	47	
11:45:00	0:01:00	51.4	64.5	55	47	
11:46:00	0:01:00	52.6	56.1	54	48	
11:47:00	0:01:00	51.6	55.2	53	48	
11:48:00	0:01:00	48	49.3	48	47	
11:49:00	0:01:00	48.7	50.5	49	47	
11:50:00	0:01:00	47.3	48.2	48	46	
11:51:00	0:01:00	46.3	47.6	47	45	
11:52:00	0:01:00	47	49.9	47	46	
11:53:00	0:01:00	53.7	69.8	58	48	Despiked – statistical outlier
11:54:00	0:01:00	47.7	49.1	48	47	
11:55:00	0:01:00	47.5	50.2	48	46	
11:56:00	0:01:00	47.3	49.2	48	46	
11:57:00	0:01:00	47.8	48.6	48	47	
11:58:00	0:01:00	48.6	49.9	49	47	
11:59:00	0:01:00	47.9	49.4	48	47	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.10h – Noise Monitoring Data (dBA): Rockland Avenue & Ridgeway Avenue						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:40:00	0:01:00	46.4	47.8	48	46	
11:41:00	0:01:00	48.6	51	50	48	
11:42:00	0:01:00	56.4	73.5	62	46	Despiked – statistical outlier
11:43:00	0:01:00	47.5	55.5	48	46	
11:44:00	0:01:00	52.5	65	58	48	
11:45:00	0:01:00	52	66.5	58	46	
11:46:00	0:01:00	51.2	55.3	54	46	
11:47:00	0:01:00	52.1	55.4	54	50	
11:48:00	0:01:00	47.3	49.1	48	46	
11:49:00	0:01:00	46.7	47.7	48	46	
11:50:00	0:01:00	47.6	50.9	50	46	
11:51:00	0:01:00	45.3	46.6	46	44	
11:52:00	0:01:00	47.6	64	48	46	
11:53:00	0:01:00	54.4	71	58	48	Despiked – statistical outlier
11:54:00	0:01:00	49	51.3	50	48	
11:55:00	0:01:00	47.9	51.3	50	46	
11:56:00	0:01:00	46.2	52.6	46	46	
11:57:00	0:01:00	47.6	49	48	46	
11:58:00	0:01:00	48.4	50.2	50	48	
11:59:00	0:01:00	48.1	52.5	50	46	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Figure A.10a: Diurnal $L_{eq(h)}$ Plot – Twinbrook (SE Twinbrook) Study Area

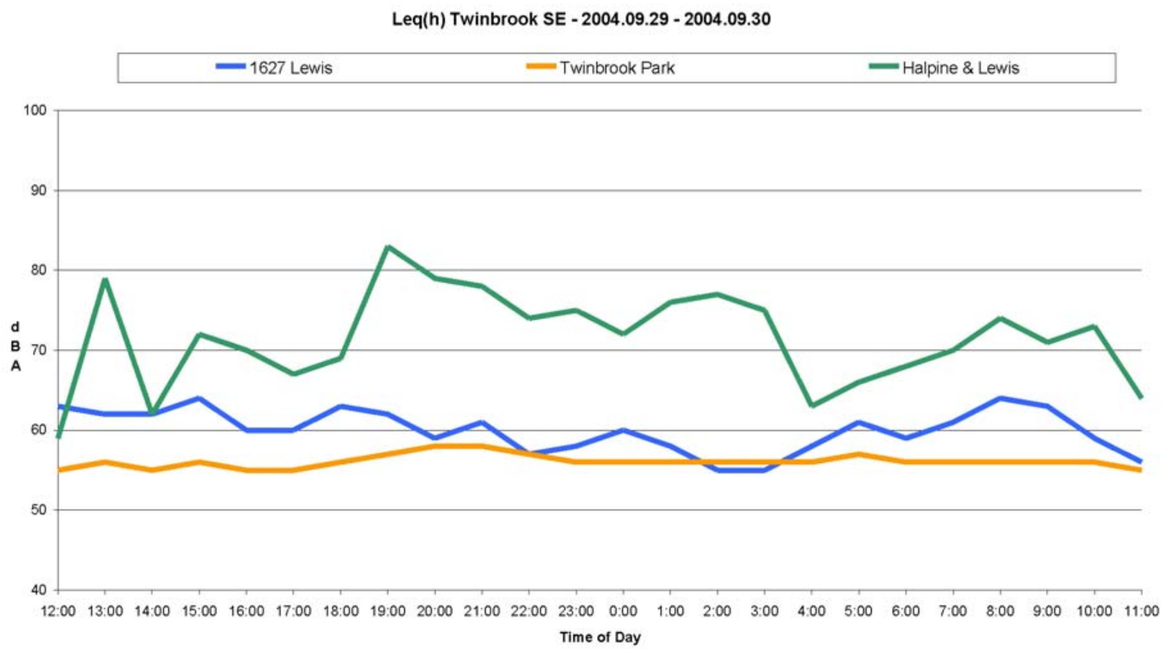
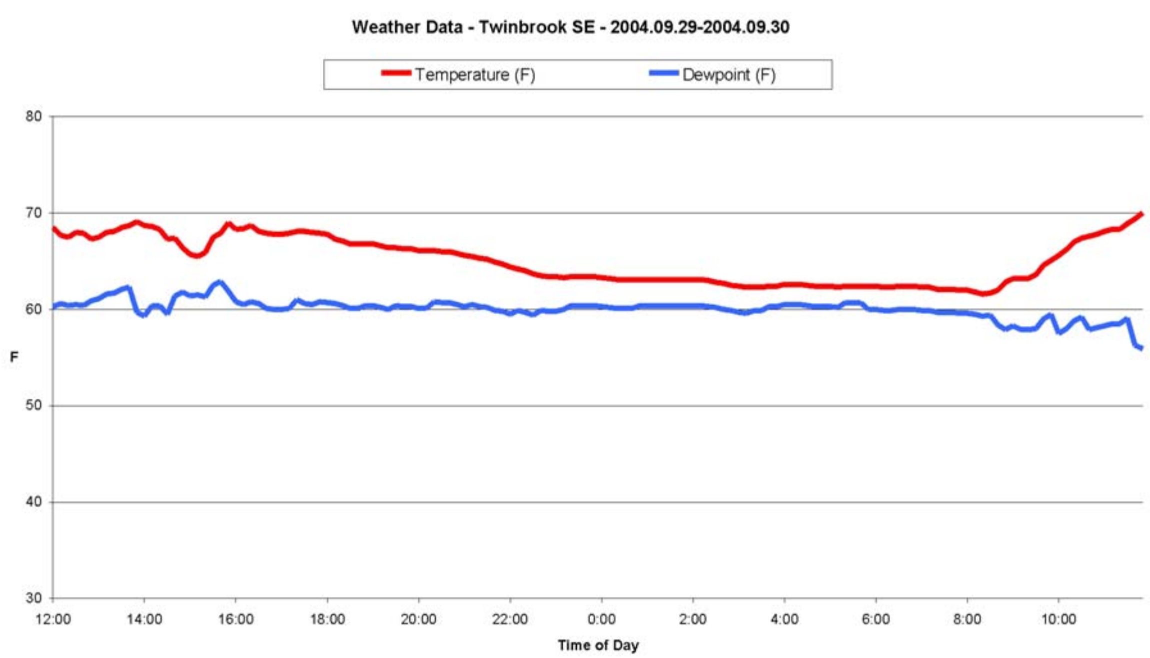


Figure A.10b: Weather Data – Twinbrook (SE Twinbrook) Study Area



A.11 Watts Branch Parkway – Rose Hill Development (Rockshire, Fallswood, Saddlebrook, Rose Hill, Rose Hill Falls)

Table A.11a – Noise Monitoring Data Summary (dBA): Watts Branch Parkway – Rose Hill Development (Rockshire, Fallswood, Saddlebrook, Rose Hill, Rose Hill Falls)

Location	$L_{eq(h)}$	L_{max}	L_{10}	L_{90}	L_{dn}	L_{eq24h}	Comment
520 Watts Branch	66	78	66	65	68	63	24-hour. Impacted
Loch Ness & Watts Br	66	81	68	64	67	63	24-hour. Impacted
14 Ingleside Ct	68	81	69	67	71	66	24-hour. Impacted
9 Grovepoint Ct	56	62	56	55	N/A	N/A	Short-term. Not impacted
3 Grovepoint Ct	54	68	55	54	N/A	N/A	Short-term. Not impacted
9 Woodsend Pl	62*	67	62*	61*	N/A	N/A	Short-term. Not impacted
Woodsend Pl & Ct	61*	54	61*	60*	N/A	N/A	Short-term. Not impacted
120' W of 520 Watts B	65	69	66	64	N/A	N/A	Short-term. Not impacted
428 Watts Branch	68	71	68	67	N/A	N/A	Short-term. Impacted
3 Fallswood Ct	61	76	61	59	N/A	N/A	Short-term. Not impacted
Fallswood Ct & WB	67	71	68	66	N/A	N/A	Short-term. Impacted
1418 Fallswood Dr	55*	64	57*	53*	N/A	N/A	Short-term. Not impacted
1405 Fallswood Dr	59*	68	61*	57*	N/A	N/A	Short-term. Not impacted
Winding Rose	65*	69	67*	65*	N/A	N/A	Short-term. Not impacted
200' E of I-270	68*	76	68*	65*	N/A	N/A	Short-term. Impacted
Winding Rose-Bl Hosta	69*	72	70*	67*	N/A	N/A	Short-term. Impacted
20 Blue Hosta	63*	66	63*	62*	N/A	N/A	Short-term. Not impacted
Blaze Climber Tennis	64*	67	65*	63*	N/A	N/A	Short-term. Not impacted
Winding Rose-Nocturn	57*	74	63*	50*	N/A	N/A	Short-term. Not impacted
Rose Petal & Gr Falls	68	84	74	58	N/A	N/A	Short-term. Impacted
Rose Petal & Autmn W	53*	60	55*	47*	N/A	N/A	Short-term. Not impacted

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the highest 1-hour levels from the monitoring data.
**Adjusted to correspond to loudest-hour data obtained at nearest 24-hour monitor at 520 Watts Branch Parkway.*

Table A.11b – Noise Monitoring Data (dBA): 520 Watts Branch Parkway

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
10:00	1:00:00	65	75	66	64	
11:00	1:00:00	65	72	66	64	
12:00	1:00:00	65	70	65	64	
13:00	1:00:00	65	71	65	64	
14:00	1:00:00	65	72	66	64	
15:00	1:00:00	65	75	66	64	
16:00	1:00:00	64	69	65	63	
17:00	1:00:00	64	66	65	63	
18:00	1:00:00	63	74	64	62	
19:00	1:00:00	63	66	64	62	
20:00	1:00:00	62	67	63	61	
21:00	1:00:00	62	65	63	61	
22:00	1:00:00	61	65	62	60	
23:00	1:00:00	60	73	61	57	
0:00	1:00:00	58	63	60	56	
1:00	1:00:00	56	62	58	53	
2:00	1:00:00	55	62	58	51	
3:00	1:00:00	57	63	59	53	
4:00	1:00:00	60	67	62	57	
5:00	1:00:00	64	70	65	62	

Table A.11b – Noise Monitoring Data (dBA): 520 Watts Branch Parkway						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
6:00	1:00:00	65	77	66	63	
7:00	1:00:00	63	71	64	62	
8:00	1:00:00	65	72	66	64	
9:00	1:00:00	66	71	66	65	Loudest-hour $L_{eq(h)}$
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.11c – Noise Monitoring Data (dBA): Loch Ness Court & Watts Branch Parkway						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
10:00	1:00:00	65	79	66	63	
11:00	1:00:00	64	77	66	63	
12:00	1:00:00	64	77	66	63	
13:00	1:00:00	64	80	66	63	
14:00	1:00:00	65	77	67	63	
15:00	1:00:00	65	77	67	63	
16:00	1:00:00	64	77	67	62	
17:00	1:00:00	65	76	67	62	
18:00	1:00:00	64	79	66	61	
19:00	1:00:00	64	77	66	61	
20:00	1:00:00	63	74	65	60	
21:00	1:00:00	62	73	63	60	
22:00	1:00:00	61	72	62	59	
23:00	1:00:00	59	75	61	57	
0:00	1:00:00	58	76	60	55	
1:00	1:00:00	56	78	59	52	
2:00	1:00:00	55	69	58	51	
3:00	1:00:00	56	74	59	52	
4:00	1:00:00	59	67	61	56	
5:00	1:00:00	63	73	64	61	
6:00	1:00:00	64	80	66	62	
7:00	1:00:00	65	80	67	62	
8:00	1:00:00	66	81	68	64	Loudest-hour $L_{eq(h)}$
9:00	1:00:00	65	78	66	64	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.						

Table A.11d – Noise Monitoring Data (dBA): 14 Ingleside Court						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
10:00	1:00:00	68	71	69	67	Loudest-hour $L_{eq(h)}$
11:00	1:00:00	68	75	69	66	Loudest-hour $L_{eq(h)}$
12:00	1:00:00	67	75	68	66	
13:00	1:00:00	67	76	68	66	
14:00	1:00:00	68	74	69	67	Loudest-hour $L_{eq(h)}$
15:00	1:00:00	67	71	68	66	
16:00	1:00:00	67	74	68	65	
17:00	1:00:00	67	75	68	65	
18:00	1:00:00	66	77	67	65	
19:00	1:00:00	66	71	67	64	
20:00	1:00:00	65	72	67	64	

Table A.11d – Noise Monitoring Data (dBA): 14 Ingleside Court

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
21:00	1:00:00	65	72	66	63	
22:00	1:00:00	65	79	66	62	
23:00	1:00:00	63	81	65	60	
0:00	1:00:00	61	70	64	58	
1:00	1:00:00	60	69	63	55	
2:00	1:00:00	59	68	62	54	
3:00	1:00:00	60	74	64	55	
4:00	1:00:00	63	73	66	59	
5:00	1:00:00	67	78	68	65	
6:00	1:00:00	67	77	68	66	
7:00	1:00:00	66	71	67	65	
8:00	1:00:00	68	72	69	67	Loudest-hour $L_{eq(h)}$
9:00	1:00:00	68	73	69	67	Loudest-hour $L_{eq(h)}$

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent the 1-hour equivalent levels from the monitoring data.

Table A.11e – Noise Monitoring Data (dBA): 9 Grovepoint Court

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
10:35:00	0:01:00	55.4	57.9	56	54	
10:36:00	0:01:00	56.6	58.7	57	55	
10:37:00	0:01:00	57.2	61.9	58	55	
10:38:00	0:01:00	55.4	56.7	56	54	
10:39:00	0:01:00	55.9	59	57	55	
10:40:00	0:01:00	55.3	59	56	53	
10:41:00	0:01:00	54.8	55.6	55	54	
10:42:00	0:01:00	55.7	56.6	56	55	
10:43:00	0:01:00	56.8	58.2	57	56	
10:44:00	0:01:00	55.9	57.1	56	55	
10:45:00	0:01:00	56	57	56	55	
10:46:00	0:01:00	54.3	56.3	55	53	
10:47:00	0:01:00	55.8	57.1	56	54	
10:48:00	0:01:00	56.3	56.8	56	56	
10:49:00	0:01:00	55.1	56.1	55	54	

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.

Table A.11f – Noise Monitoring Data (dBA): 3 Grovepoint Court

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
10:35:00	0:01:00	54.1	57.4	56	54	
10:36:00	0:01:00	54.8	56.9	56	54	
10:37:00	0:01:00	55.2	58.2	56	54	
10:38:00	0:01:00	53.8	54.6	54	54	
10:39:00	0:01:00	54	55	54	54	
10:40:00	0:01:00	53.7	55.1	54	52	
10:41:00	0:01:00	53.7	54.9	54	54	
10:42:00	0:01:00	54.1	55.4	54	54	
10:43:00	0:01:00	55.6	67.9	56	54	
10:44:00	0:01:00	54.6	56.1	56	54	
10:45:00	0:01:00	54.5	55.7	56	54	

Table A.11f – Noise Monitoring Data (dBA): 3 Grovepoint Court

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
10:46:00	0:01:00	53	54.2	54	52	
10:47:00	0:01:00	54.5	55.9	56	54	
10:48:00	0:01:00	54.6	55.4	56	54	
10:49:00	0:01:00	53.3	56.9	54	52	

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.

Table A.11g – Noise Monitoring Data (dBA): 9 Woodsend Court

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
11:00:00	0:01:00	60.9	62.7	62	59	
11:01:00	0:01:00	61.2	61.9	61	60	
11:02:00	0:01:00	60.9	62.4	62	60	
11:03:00	0:01:00	59.8	61.2	60	59	
11:04:00	0:01:00	60.7	61.9	61	60	
11:05:00	0:01:00	61	62.3	61	60	
11:06:00	0:01:00	60.7	61.8	61	60	
11:07:00	0:01:00	61.2	61.9	61	60	
11:08:00	0:01:00	60.9	61.8	61	60	
11:09:00	0:01:00	60.5	61.8	61	59	
11:10:00	0:01:00	61.5	63.1	62	60	
11:11:00	0:01:00	60.4	61.6	61	59	
11:12:00	0:01:00	60.6	61.6	61	60	
11:13:00	0:01:00	60.9	62.7	61	60	
11:14:00	0:01:00	60.6	61.8	61	60	
11:15:00	0:01:00	60.3	66.7	61	59	

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.

Table A.11h – Noise Monitoring Data (dBA): Woodsend Court & Woodsend Place

Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
11:00:00	0:01:00	59.6	61.5	60	58	
11:01:00	0:01:00	59.8	60.6	60	60	
11:02:00	0:01:00	59.8	61.7	60	58	
11:03:00	0:01:00	58.5	59.3	60	58	
11:04:00	0:01:00	59.2	59.8	60	58	
11:05:00	0:01:00	59.7	60.7	60	60	
11:06:00	0:01:00	59.9	60.6	60	60	
11:07:00	0:01:00	59.8	60.5	60	60	
11:08:00	0:01:00	59.6	60.5	60	60	
11:09:00	0:01:00	59.4	61	60	58	
11:10:00	0:01:00	60.6	63.9	62	60	
11:11:00	0:01:00	59	59.7	60	58	
11:12:00	0:01:00	59.4	60.3	60	60	
11:13:00	0:01:00	59.6	60.6	60	60	
11:14:00	0:01:00	59.1	59.8	60	58	
11:15:00	0:01:00	58.9	59.8	60	58	

All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.

Table A.11i – Noise Monitoring Data (dBA): 120' West of 520 Watts Branch Parkway						
Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
11:25:00	0:01:00	66	66.8	66	66	
11:26:00	0:01:00	64.7	65.8	66	64	
11:27:00	0:01:00	65.3	67.4	66	64	
11:28:00	0:01:00	65.1	66.6	66	64	
11:29:00	0:01:00	65.5	66.6	66	64	
11:30:00	0:01:00	64.8	66.3	66	64	
11:31:00	0:01:00	65.6	66.6	66	64	
11:32:00	0:01:00	65.3	66.2	66	64	
11:33:00	0:01:00	66.1	69	68	66	
11:34:00	0:01:00	65.4	66.6	66	64	
11:35:00	0:01:00	65	67.1	66	64	
11:36:00	0:01:00	65.7	67	66	66	
11:37:00	0:01:00	65.5	66.3	66	64	
11:38:00	0:01:00	65.5	67	66	64	
11:39:00	0:01:00	65.4	67.5	66	64	
11:40:00	0:01:00	65.6	67.2	66	64	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11j – Noise Monitoring Data (dBA): 428 Watts Branch Parkway						
Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
11:25:00	0:01:00	68.4	69.5	69	67	
11:26:00	0:01:00	66.9	68.2	67	65	
11:27:00	0:01:00	67.6	69.8	69	66	
11:28:00	0:01:00	67.4	68.9	68	65	
11:29:00	0:01:00	68	69.1	68	66	
11:30:00	0:01:00	67.3	68.9	68	66	
11:31:00	0:01:00	68	69	68	67	
11:32:00	0:01:00	67.6	68.7	68	67	
11:33:00	0:01:00	68.7	71.1	69	67	
11:34:00	0:01:00	68	69.4	68	67	
11:35:00	0:01:00	67.2	68	67	66	
11:36:00	0:01:00	68.7	69.6	69	68	
11:37:00	0:01:00	68.1	69.1	68	67	
11:38:00	0:01:00	68.1	69.5	69	67	
11:39:00	0:01:00	67.7	69.2	68	66	
11:40:00	0:01:00	68.1	69.4	69	67	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11k – Noise Monitoring Data (dBA): 3 Fallswood Court						
Time	Duration	L_{eq}	L_{max}	L_{10}	L_{90}	Comment
11:46:00	0:01:00	62.9	75.9	63	60	Despiked – statistical outlier
11:47:00	0:01:00	60.7	61.2	61	60	
11:48:00	0:01:00	60.3	61.9	61	59	
11:49:00	0:01:00	59.9	61.1	60	57	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11l – Noise Monitoring Data (dBA): Fallswood Court & Watts Branch Parkway						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
11:46:00	0:01:00	67.1	70.5	68	66	
11:47:00	0:01:00	67.4	68.5	68	68	
11:48:00	0:01:00	67.1	69.7	68	66	
11:49:00	0:01:00	66.4	69	68	64	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11m – Noise Monitoring Data (dBA): 1418 Fallswood Drive						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:00:00	0:01:00	54.8	61.1	56	54	
12:01:00	0:01:00	56.3	63.4	62	52	
12:02:00	0:01:00	55.1	63.8	58	52	
12:03:00	0:01:00	51.9	53.5	52	52	
12:04:00	0:01:00	52.2	52.8	52	52	
12:05:00	0:01:00	52.9	53.8	54	52	
12:06:00	0:01:00	52.6	53.8	54	52	
12:07:00	0:01:00	52.3	53	52	52	
12:08:00	0:01:00	52.5	53.3	52	52	
12:09:00	0:01:00	52.5	53.8	54	52	
12:10:00	0:01:00	53.6	54.4	54	54	
12:11:00	0:01:00	53.6	57.4	54	52	
12:12:00	0:01:00	55	63	58	52	
12:13:00	0:01:00	53.9	58.1	54	52	
12:14:00	0:01:00	52.6	53.4	54	52	
12:15:00	0:01:00	51.8	52.7	52	52	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11n – Noise Monitoring Data (dBA): 1405 Fallswood Drive						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:00:00	0:01:00	58.4	62.2	59	57	
12:01:00	0:01:00	59.3	67.5	62	57	
12:02:00	0:01:00	58.3	65.2	59	57	
12:03:00	0:01:00	57.7	62	59	55	
12:04:00	0:01:00	58.3	65.1	59	56	
12:05:00	0:01:00	57.6	58.6	58	56	
12:06:00	0:01:00	57.5	58.6	58	56	
12:07:00	0:01:00	57.6	58.6	58	56	
12:08:00	0:01:00	57.7	58.5	58	56	
12:09:00	0:01:00	57.4	58.9	58	55	
12:10:00	0:01:00	58.1	59.2	58	57	
12:11:00	0:01:00	57.6	58.4	58	56	
12:12:00	0:01:00	57.9	62.5	58	56	
12:13:00	0:01:00	58.4	60.2	58	57	
12:14:00	0:01:00	57.6	58.8	58	57	
12:15:00	0:01:00	56.9	58.2	57	56	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11o – Noise Monitoring Data (dBA): Winding Rose Drive & Winding Rose Drive						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:35:00	0:01:00	64.4	65.7	66	64	
12:36:00	0:01:00	65.1	67.4	66	64	
12:37:00	0:01:00	64.4	65.4	66	64	
12:38:00	0:01:00	64.1	66.2	64	64	
12:39:00	0:01:00	64.2	69.2	66	64	
12:40:00	0:01:00	64.2	65.5	66	64	
12:41:00	0:01:00	64.6	67.8	66	64	
12:42:00	0:01:00	64	67.4	66	62	
12:43:00	0:01:00	63.1	65.3	64	62	
12:44:00	0:01:00	63.5	64.8	64	62	
12:45:00	0:01:00	64	65.8	66	64	
12:46:00	0:01:00	64.1	66.6	66	62	
12:47:00	0:01:00	63.3	65.2	64	62	
12:48:00	0:01:00	64.5	71.9	66	64	
12:49:00	0:01:00	64.2	69.3	66	62	
12:50:00	0:01:00	64	66.2	64	64	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11p – Noise Monitoring Data (dBA): Winding Rose Drive, 200' East of I-270						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
12:35:00	0:01:00	66.9	67.9	67	66	
12:36:00	0:01:00	67.5	70.7	68	66	
12:37:00	0:01:00	66.8	68.5	67	65	
12:38:00	0:01:00	66.7	68.4	67	65	
12:39:00	0:01:00	67.7	76.2	69	65	
12:40:00	0:01:00	66.8	68.1	67	65	
12:41:00	0:01:00	67	69.5	68	64	
12:42:00	0:01:00	66	68.5	67	64	
12:43:00	0:01:00	65.4	68	67	63	
12:44:00	0:01:00	65.9	67.4	66	65	
12:45:00	0:01:00	66.1	67.9	67	64	
12:46:00	0:01:00	66.5	70.5	67	64	
12:47:00	0:01:00	65.8	67.4	66	65	
12:48:00	0:01:00	66.2	67.5	67	65	
12:49:00	0:01:00	66.4	68.8	67	65	
12:50:00	0:01:00	66.7	68.7	67	65	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11q – Noise Monitoring Data (dBA): Winding Rose Drive & Blue Hosta Way						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:00:00	0:01:00	69.1	72.2	70	68	
13:01:00	0:01:00	67.4	68.6	68	66	
13:02:00	0:01:00	67.6	69	68	66	
13:03:00	0:01:00	67.7	68.7	68	66	
13:04:00	0:01:00	68.3	70.2	70	66	
13:05:00	0:01:00	67.4	69	68	66	
13:06:00	0:01:00	70.2	80.2	74	66	Despiked – statistical outlier
13:07:00	0:01:00	68.1	70.6	70	68	

Table A.11q – Noise Monitoring Data (dBA): Winding Rose Drive & Blue Hosta Way						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:08:00	0:01:00	67.3	68.8	68	66	
13:09:00	0:01:00	68	69.3	68	66	
13:10:00	0:01:00	67.1	68.2	68	66	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11r – Noise Monitoring Data (dBA): 20 Blue Hosta Way						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:00:00	0:01:00	62.6	65.5	63	61	
13:01:00	0:01:00	61.2	62.5	62	60	
13:02:00	0:01:00	61.8	62.7	62	61	
13:03:00	0:01:00	61.8	63.2	62	61	
13:04:00	0:01:00	62	63.1	62	61	
13:05:00	0:01:00	61.3	63.2	62	60	
13:06:00	0:01:00	63	70.8	67	60	Despiked – statistical outlier
13:07:00	0:01:00	61.8	63.1	62	60	
13:08:00	0:01:00	61.3	62.8	62	59	
13:09:00	0:01:00	61.8	62.8	62	61	
13:10:00	0:01:00	60.7	61.6	61	59	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11s – Noise Monitoring Data (dBA): Blaze Climber Way Tennis Courts						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:25:00	0:01:00	62.5	64.1	64	62	
13:26:00	0:01:00	63.7	64.7	64	64	
13:27:00	0:01:00	64	66.8	66	62	
13:28:00	0:01:00	62.8	63.9	64	62	
13:29:00	0:01:00	63.2	64.1	64	62	
13:30:00	0:01:00	63.5	64.5	64	62	
13:31:00	0:01:00	63.3	64.9	64	62	
13:32:00	0:01:00	63.2	64.6	64	62	
13:33:00	0:01:00	63.6	64.5	64	64	
13:34:00	0:01:00	63.5	64.2	64	64	
13:35:00	0:01:00	63.7	64.8	64	62	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11t – Noise Monitoring Data (dBA): Winding Rose Drive & Nocturne Court						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:25:00	0:01:00	53.5	62.8	59	49	
13:26:00	0:01:00	54.9	66.2	61	49	
13:27:00	0:01:00	57.9	74.3	63	49	Despiked – statistical outlier
13:28:00	0:01:00	54.3	68.3	58	49	
13:29:00	0:01:00	56.7	69.5	62	49	
13:30:00	0:01:00	57.2	70.3	66	49	
13:31:00	0:01:00	56.8	69.1	64	49	
13:32:00	0:01:00	58.2	70.9	65	49	

Table A.11t – Noise Monitoring Data (dBA): Winding Rose Drive & Nocturne Court						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:33:00	0:01:00	62	74.1	70	49	Despiked – statistical outlier
13:34:00	0:01:00	58.1	71	67	50	
13:35:00	0:01:00	50.5	54	51	49	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11u – Noise Monitoring Data (dBA): Rose Petal Way & Great Falls Road						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:40:00	0:01:00	69.8	82.9	75	60	
13:41:00	0:01:00	67.3	77.4	74	55	
13:42:00	0:01:00	67.3	75	73	56	
13:43:00	0:01:00	67.5	75.5	72	60	
13:44:00	0:01:00	66.2	77.4	71	58	
13:45:00	0:01:00	69.9	84	75	59	
13:46:00	0:01:00	70.1	78.7	75	60	
13:47:00	0:01:00	65.9	75	71	58	
13:48:00	0:01:00	67.3	81	73	58	
13:49:00	0:01:00	72.4	78.8	76	65	
13:50:00	0:01:00	69	78.6	75	59	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Table A.11v – Noise Monitoring Data (dBA): Rose Petal Way & Autumn Wind Way						
Time	**Duration**	**L_{eq}**	**L_{max}**	**L_{10}**	**L_{90}**	**Comment**
13:40:00	0:01:00	50.8	60.1	56	46	
13:41:00	0:01:00	53.3	59.3	58	46	
13:42:00	0:01:00	55.3	67.9	62	46	Despiked – statistical outlier
13:43:00	0:01:00	48	49.8	50	46	
13:44:00	0:01:00	49.7	53.8	52	46	
13:45:00	0:01:00	47.2	53.7	50	46	
13:46:00	0:01:00	50	57.8	56	46	
13:47:00	0:01:00	45.8	47.7	46	46	
13:48:00	0:01:00	46	51	48	46	
13:49:00	0:01:00	48.2	52.2	50	46	
All data in A-weighted decibels (dBA). $L_{eq(h)}$, L_{10} and L_{90} represent 1-minute equivalent data from the short-term monitoring session.						

Figure A.11a: Diurnal $L_{eq(h)}$ Plot – Watts Branch Parkway – Rose Hill Development (Rockshire, Fallswood, Saddlebrook, Rose Hill, Rose Hill Falls) Study Area

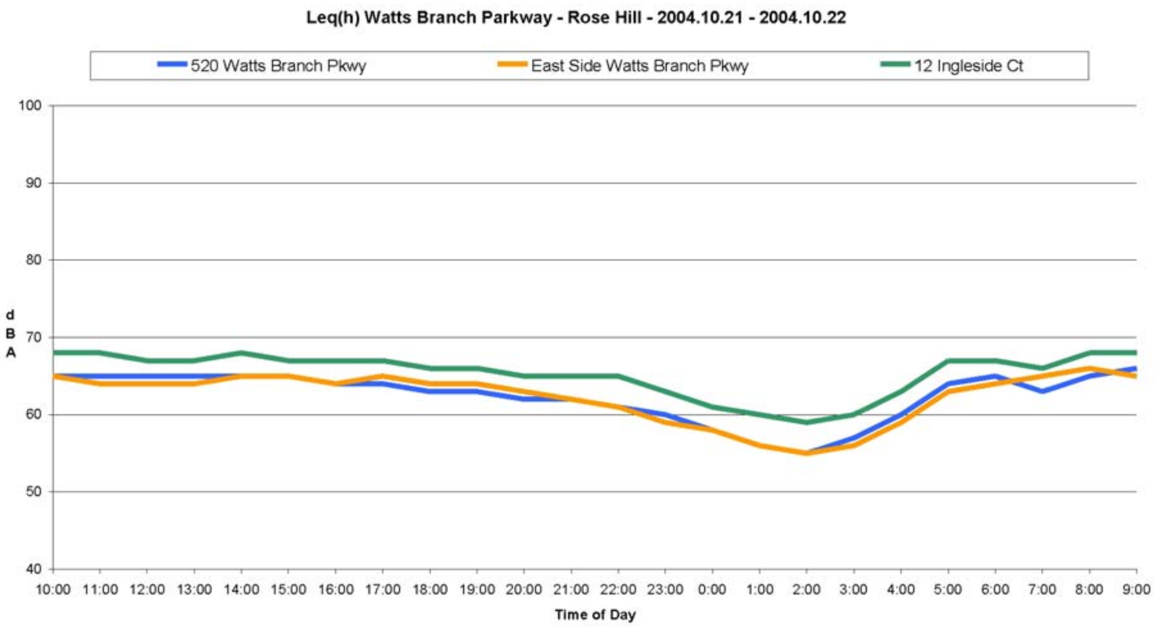
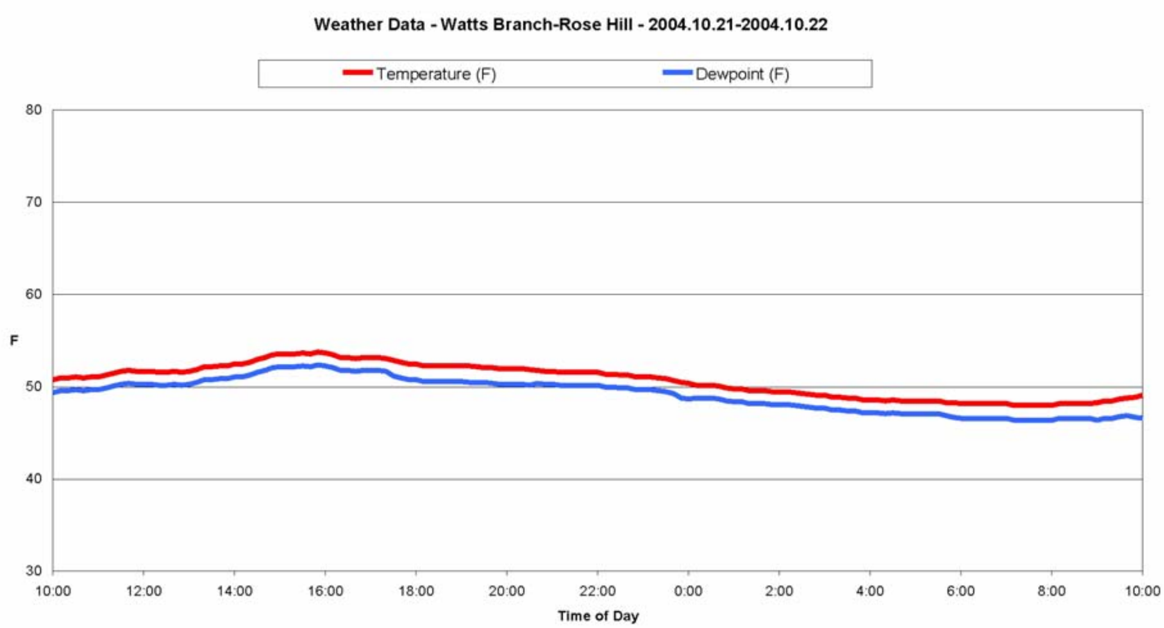


Figure A.11b: Weather Data – Watts Branch Parkway – Rose Hill Development (Rockshire, Fallswood, Saddlebrook, Rose Hill, Rose Hill Falls) Study Area



CITY OF ROCKVILLE

TRANSPORTATION NOISE STUDY
FINAL REPORT – APPENDIX B:
EXISTING NOISE ENVIRONMENT

April 15, 2005

Prepared for

City of Rockville, Maryland

Prepared by

Rummel, Klepper & Kahl, LLP

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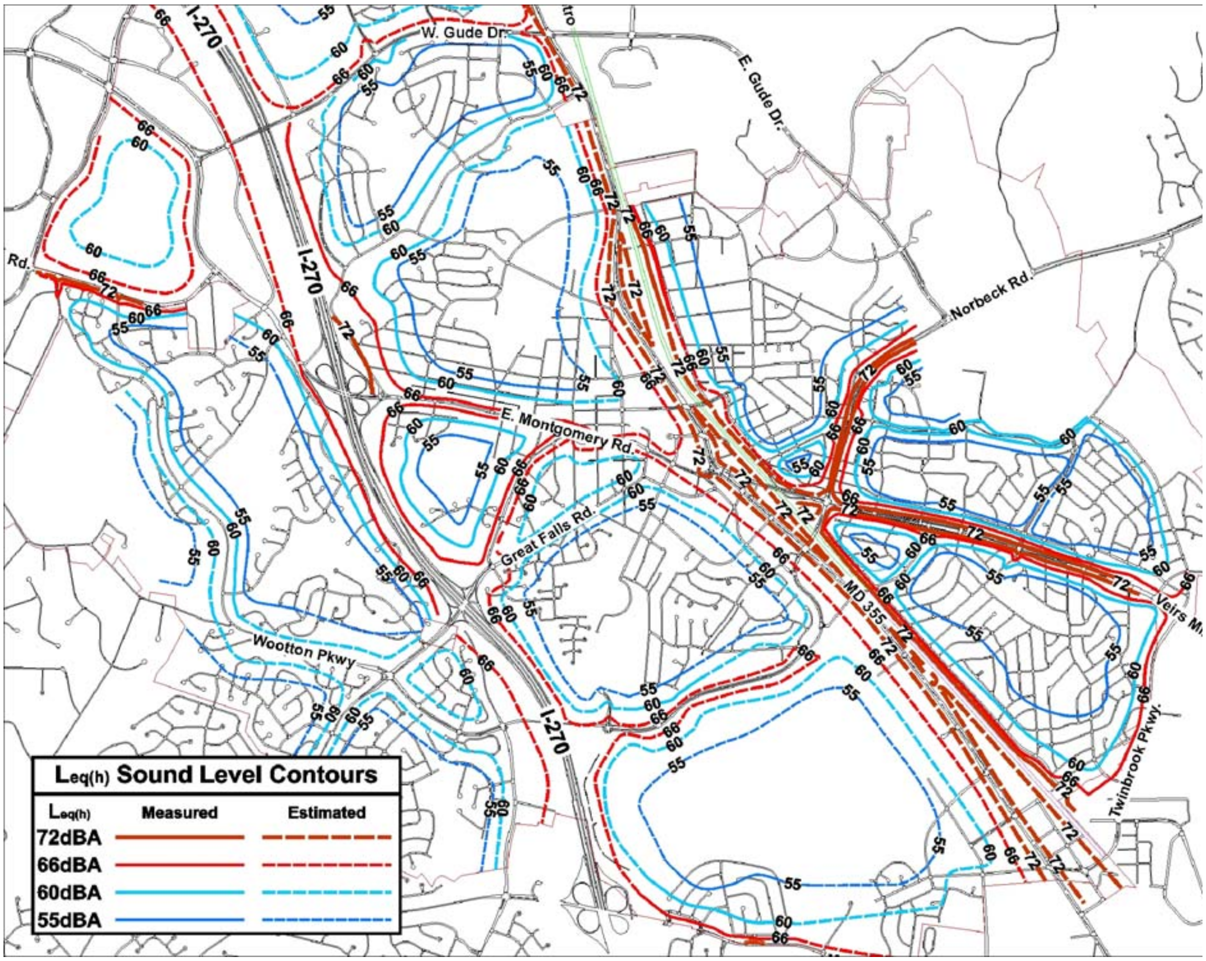
Figure B.1: Measured and Estimated Noise Contours (55, 60, 66 and 72dBA)



CITY OF ROCKVILLE

TRANSPORTATION NOISE STUDY
FINAL REPORT – APPENDIX C:
NOISE POLICY COMPARISON

April 15, 2005

Prepared for

City of Rockville, Maryland

Prepared by

Rummel, Klepper & Kahl, LLP

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Introduction

The following text cites key elements of Federal Highway Administration, Maryland State Highway Administration, Montgomery County Department of Public Works and Transportation, and Maryland National Capital Park and Planning Commission transportation noise policies for the purpose of assisting with the development of the City's transportation noise policy. It compares only key elements of Federal, State, and County transportation noise policies; this comparison is not comprehensive. For example, no comparative analysis has been made with respect to sound barrier analysis or implementation funding, costs, or cost sharing. It is intended to serve only as a basis for future reference by the City in its efforts to create and adopt a formal transportation noise policy.

C.1 Noise Impact Criteria:

FHWA:
FHWA Noise Abatement Criteria (NAC) defines an exterior residential noise impact as a residence for which transportation noise creates or is predicted to create loudest-hour equivalent sound levels, $L_{eq(h)}$, equal to or greater than 66dBA.

MDSHA:
MDSHA adheres to FHWA Noise Abatement Criteria (NAC), which defines an exterior residential noise impact as a residence for which transportation noise creates or is predicted to create loudest-hour equivalent sound levels, $L_{eq(h)}$, equal to or greater than 66dBA, or if existing noise levels are projected to increase by more than 10 dBA and exceed 57dBA.

MCDPWT:
MCDPWT defines traffic noise impacts as ground-level dwellings or other noise-sensitive areas found to have peak-noise hour equivalent sound levels equal to or greater than 67dBA. Predicted noise impacts are based upon level of service "D" (LOS-D) traffic noise predictions.

M-NCPPC:
M-NCPPC utilizes day-night average sound level (see Appendix D), L_{dn}, to quantify transportation noise impacts in three "areas of application": permanent rural areas, suburban areas, and the urban ring. The guideline value for transportation impacts is 55dBA in permanent rural areas, 60dBA in suburban areas, and 65dBA in the urban ring, freeway, and major highway corridor areas. M-NCPPC assesses noise levels at the building line of habitable structures – not the property line or other exterior areas of frequent human use.

City of Rockville:
On Tuesday, November 16, 2004 the City of Rockville's Environmental Commission, the City of Rockville's Traffic & Transportation Commission, and representatives from Rummel, Klepper & Kahl, LLP met to discuss the procedures associated with the noise monitoring effort, the preliminary results and to define a noise level impact threshold. Following a discussion on the definition of transportation noise, impact criteria of adjacent governmental agencies, including Federal Highway Administration, Maryland State Highway Administration, Montgomery County and the Maryland National Capital Park and Planning Commission, the City's Commissions agreed to use the 66dBA loudest-hour equivalent sound level ($L_{eq(h)}$ = 66dBA) as the criterion for transportation noise impacts in exterior residential areas.

C.2 Noise Monitoring:

Receptor Locations:

FHWA:

FHWA "Highway Traffic Noise Analysis and Abatement Policy and Guidance", updated 1995, states that:

> The noise measurement should yield the worst hourly noise level generated from representative noise sources for that area...Measurements should be made at representative locations...Measurements are normally restricted to exterior areas of frequent human use...Measurements are usually taken in one of three exterior locations: (1) at or near the highway right-of-way line; (2) at or near buildings in residential or commercial areas; and (3) at an area between the right-of-way line and the building where frequent human activity occurs, such as a patio or the yard of a home.

MDSHA:

Per MDSHA Statewide Highway Noise Program Appendix D, "Measurement locations should be representative of areas of "typical human use" on the subject property." Furthermore, it cites that extreme locations on a property be avoided unless the study requirements dictate otherwise.[1]

MDSHA Office of Environmental Design (MDSHA-OED) closely manages all SHA sound barrier studies, including the location of noise monitoring receptors. MDSHA dictates that noise sensitive areas are verified in the field to ensure that present mapping reflects current development activities.

MCDPWT:

In the "Determination of Need" paragraph of Montgomery County's Department of Public Works and Transportation Highway Noise Abatement Policy's "Traffic Assessment" section, basic guidelines for noise monitoring receptor location are stated as follows:

> "Noise exposures will be quantified at a RECEPTOR located in an area of *common* human activity within a residential lot. This location generally be between the right-of-way line and the closest wall of the residence to the highway."

Furthermore, Appendix C, "Transportation Noise Analysis", Paragraph e) Location of "Receptors" for the Noise Analysis states:

> "One of the factors affecting sound level is the distance from the source of noise to the receptor. Depending on the size and configuration of residential lots, sound levels can vary noticeably when measured and/or calculated at the edge of the right of way line, or immediately adjacent to the exterior wall of a home. For the Transportation Noise Policy, the noise analysis will be conducted assuming that the receptors will be located in an area of common human activity within the residential lot. This location will generally be between the right of way line and the closest wall of the residence to the highway. This location is consistent with State and Federal practices."

M-NCPPC:

M-NCPPC assesses noise levels at the building line of habitable structures – not the property line or other exterior areas of frequent human use.

[1] This planning-level noise study is an example of a study that required noise monitoring data at extreme locations (near right-of-way lines). Noise monitoring data would not be obtained at locations in close proximity to transportation noise sources for most noise mitigation analysis studies.

Noise Monitoring Sessions:

USDOT / FHWA:

FHWA Highway Traffic Noise Analysis and Abatement Policy and Guidance does not specify guidelines for number and/or duration of noise monitoring sessions; however, section 4.4 of USDOT Measurement of Highway-Related Noise (1996) states:

> Different sound sources require different sampling periods. For multiple-source conditions, a longer sampling period is needed to obtain a representative sample, averaged over all conditions. Typical sampling periods range from 2 to 30 minutes. In special instances where the temporal nature is expected to vary substantially, longer sampling periods, such as 1 hr or 24 hr, may be necessary.

MDSHA:

At least one 24-hour monitoring data set is obtained in conjunction with every MDSHA-OED sound barrier noise analysis study. Short-term and 24-hour monitoring data include hourly equivalent sound levels, $L_{eq(h)}$, maximum sound levels, L_{max}, and background noise levels, L_{90}, recorded for each interval. Noise monitoring session duration is dependent upon highway traffic volume. High-volume traffic noise monitoring sessions may be as short as ten minutes; low-volume rural highways may require monitoring sessions of up to an hour to be statistically reliable. MDSHA Statewide Highway Noise Program explicitly states "[a] minimum of two complete sets of…measurements shall be obtained in all studies on different days and at different times of day…" However, present MDSHA-OED practice is to obtain two or more complete sets of data only in the event of significant environmental or traffic volume anomalies (such as inclement weather or a traffic accident) during collection of the first data set, or if the computer noise model can not be calibrated to within acceptable tolerances.

MDSHA-OED closely directs the number and duration of noise monitoring sessions for its sound barrier noise analysis studies. Presently, MDSHA-OED requires short-term monitoring to be performed in 20-minute sessions starting zero, twenty, or forty minutes after the hour, and in as many locations as is necessary to comprehensively capture the noise environment throughout the study area.

MCDPWT:

Appendix C: Development of the Highway Noise Abatement Policy for Montgomery County Maryland, paragraph e) Location of "Receptors" for the Noise Analysis states:

> In the study of a highway corridor, the County will take short duration noise measurements at sensitive locations that are representative of the area. For control purposes, and to allow the calculation of day-night sound levels, there will be at least two 24-hour noise-monitoring stations as part of the noise studies for a highway corridor.

Discussion:

A criterion of any data collection effort is that the resultant body of data sufficiently represents the subject for further analysis. In the case of transportation noise monitoring, the goal is to accurately represent existing or baseline noise conditions. Given that most non-rural ground transportation noise sources are relatively consistent, using one set of noise-monitoring data and correlating classified traffic counts has proven sufficient for achieving the goals of most sound barrier analysis studies.

C.3 Noise Modeling:

FHWA:
In 1998, FHWA released its Traffic Noise Model (TNM), which has effectively replaced STAMINA as the traffic noise computer modeling program in many states, including Maryland and Virginia. Guidelines for TNM modeling procedures are outlined in FHWA's Traffic Noise Model® User's Guide (FHWA-PD-96-009).

MDSHA:
MDSHA Sound Barrier Policy cites "utilizing the latest approved FHWA noise prediction model". Presently, FHWA's Traffic Noise Model (v2.5) for noise-level prediction is used to predict design year noise levels, "usually twenty years in the future".

MCDPWT:
MCDPWT policy states that "the latest version of the TNM computer program is expected to be the computational procedure used in noise assessments…"

Discussion:
When applicable, use of the latest version of FHWA TNM by trained and experienced noise analysts is recommended for traffic noise and traffic noise mitigation studies.

C.4: Feasibility and Reasonableness:

<u>Feasibility:</u>

<u>MDSHA:</u>

MDSHA's determination of feasibility applies to both Type I (new construction, increased capacity, and/or facility realignment) and Type II (retrofit) elements of its sound barrier program. MDSHA defines feasibility as "the engineering and acoustical ability to provide effective noise reduction", and is qualified as follows:

1. If noise levels cannot be reduced by at least 3 decibels at impacted receptors, a noise barrier will not be considered feasible. The noise reduction goal for receptors with the highest noise levels (first row receivers) is 7-10 decibels. If a noise reduction of 7-10 decibels cannot be achieved, the barrier will be considered not to be feasible.

   Noise sensitive receptors include residences, schools, churches, historical areas, cultural resources, and other places which people use that can be adversely affected by highway noise.

2. If the placement of a sound barrier will restrict pedestrian or vehicular access or would cause a safety problem, such as limiting sight distance or reduction of a vehicle recovery area, the barrier will not be considered feasible.

3. If the construction of a sound barrier will result in significant utility impacts, the barrier will not be considered feasible. Significant utility adjustments can have a major impact on barrier design options and construction costs.

4. If construction of a sound barrier will have an impact upon existing drainage, it could be considered not to be feasible. Drainage is an important element in the location and design of a sound barrier. The potential for impact to drainage patterns and systems and flooding will be considered in the overall decision on whether construction is feasible and reasonable.

<u>MCDPWT:</u>

MCDPWT defines feasibility as "the engineering ability for the construction of sound barriers that are not too disruptive of other physical and environmental features, and the acoustical ability to provide effective noise reduction", and is based on the following factors:

a) If the placement of a noise barrier will restrict pedestrian or vehicular access or would cause a safety problem, such as limiting sight distance, the barrier will be considered infeasible. This analysis will be made using standard engineering AASHTO procedures for the determination of sight distance.

b) The feasibility of a noise barrier will take into account the costs associated with modifications that may be necessary as a result of its implementation to existing landscaping, drainage systems, utility relocations, and land ownership. In cases where the implementation of a sound barrier requires the use of privately owned land, it is expected that the necessary property will be donated or permanent easements granted to the County for its implementation. Otherwise, the sound barrier may be considered infeasible. (The County does not have the ability to quick take property for sound barrier installation.)

c) For a noise barrier to be considered feasible, it must achieve a minimum reduction of seven decibels for receptors with the highest sound levels (typically the first row receivers in existing developments).

Discussion:
MDSHA's inclusion of a 7- to 10-decibel sound barrier noise reduction performance requirement in its feasibility criteria ensures a minimum return on sound barrier expenditures. A 7-decibel equivalent sound level reduction is readily perceptible. A 10-decibel equivalent sound level reduction represents a 90% reduction in sound energy and the resultant noise environment is perceived to be half as loud.

Reasonableness:
MDSHA:
MDSHA's criteria for Type I sound barrier reasonableness is as follows (Attachment 2 not included):

Each individual impact area will also be evaluated to determine if construction of a sound barrier is reasonable. Reasonableness will be based upon the following:

1. If 75% of the impacted residents do not approve the proposed sound barrier, the barrier could be considered not to be reasonable.

2. For Type I projects, if existing noise levels are expected to increase by 10 decibels or more, but will be less than 57 decibels, a sound barrier will be considered not to be reasonable.

3. For Type I projects, if a change over no-build levels of less than 3 decibels would result from a build condition, a sound barrier could be considered not to be reasonable. In the assessment of the no-build to build noise level change, consideration will be given to the cumulative effects of highway improvements made after the original highway construction. If the cumulative increase in design year build noise levels at noise sensitive receivers that existed when prior improvements were made is equal to or greater than 3 decibels, noise abatement could be considered reasonable.

   If noise levels equal or exceed 72 decibels at impacted noise sensitive receivers, SHA will consider a sound barrier reasonable for any proposed highway expansion that will increase noise levels provided that other feasibility and reasonableness criteria are met.

4. If the cost of a sound barrier will exceed $50,000 per benefited residence, the barrier will be considered not to be reasonable. The cost/residence is determined by the dividing the cost of a sound barrier by the total number of benefited residences. The total number of benefited residences will be the sum of the following:

   a. The number of impacted residences that would receive a 3 decibel or greater noise reduction.

   b. The number of non-impacted residences (noise levels below 66 dBA Leq) that would receive a 5 decibel or greater noise reduction.
   c. The number of impacted and non-impacted non-residential noise sensitive receivers (schools, churches, etc.) that would benefit from a sound barrier.

   All benefited receptors will be included in the cost/residence calculation. Non-residential receptors such as schools, churches, historic areas, etc. will be considered as equivalent residences for cost/residence calculations, based upon 10 equivalent residences for each use.

Sound barrier cost is based upon the estimated cost of the barrier system, i.e. posts, panels, foundations and retaining walls required solely to support the sound barrier. The most recent five years of bidding experience will be used to calculate the square foot factor used to estimate barrier cost. If the cost of a barrier exceeds the $50,000 maximum, SHA will fund up to the maximum, if the balance is available from another source or sources. SHA will work with the local jurisdiction on options for alternative funding.

For Type I projects, SHA will look at both the cost/residence for individual noise sensitive areas and the average cost/residence for the entire project in determining reasonableness. Noise sensitive areas with a cost/residence of less than $100,000 would be included in the project cost averaging. If the average cost/residence for the project is less that $50,000, sound barriers will be considered reasonable.

5. If a very tall sound barrier would have to be located close to the impacted receptors, and would have a negative visual impact, construction of the barrier could be considered not to be feasible. The relationship of the location of a sound barrier to the receptors to be protected will be considered in making a reasonableness determination.

6. If the construction of a sound barrier will result in an impact to a Section 4(f) resource, it could be determined not to be reasonable. Section 4(f) resources include publicly owned recreation areas and parks, wildlife areas, conservation areas and historic sites that are either on or considered eligible for the National Register of Historic Places.

   Reasonableness will consider the significance of impact and the feasibility of avoidance. A 4(f) document will be prepared as required by federal regulations and consultation and coordination with those responsible for the resource will be carried out and documented.

7. The control of new development adjacent to state highways in high noise zones at the local level is critical to the overall abatement of highway noise. Sound barrier reasonableness will consider the local priority on approving new development adjacent to state highways in the determination of providing noise abatement for highway construction or reconstruction projects.

   A feasibility and reasonableness worksheet will be completed for each noise sensitive area on both Type I and Type II projects. **See Attachment 2.** The worksheet for Type I projects will be initially completed during the environmental clearance phase of project development and finalized during and prior to the completion of final project engineering.

   It is the SHA's policy to make final decisions on the construction of Type I sound barriers during the final design phase of project development, after final horizontal and vertical alignments are determined and a detailed engineering analysis of the feasibility and reasonability of noise abatement can be made. Barriers that meet the SHA criteria as accepted by FHWA will be constructed.

   SHA will consider non sound barrier options for areas which meet the eligibility date criterion for consideration of a barrier but do not meet all of the remaining criteria for a barrier, including:

   - Soundproofing of publicly owned noise sensitive structures, if interior noise levels equal or exceed 52 dBA, on a case by case basis consistent with Federal guidelines.

- Purchase of impacted residences on a case by case basis consistent with Federal guidelines.

SHA will consider the installation of landscape screening or privacy fencing for areas which meet the eligibility date criterion, but do not meet all of the remaining criteria for a barrier.

MCDPWT:

MCDPWT's criteria for sound barrier reasonableness is as follows:

a) For a noise barrier to be considered reasonable, the measured or projected sound level must equal or exceed 67 dBA.

b) Cost effectiveness, community acceptance and possible community financial participation are important measures of reasonableness. This policy considers that $50,000 per benefited residence is a reasonable threshold for public participation on implementation of noise abatement measures. The policy also recommends that the time of the purchase of a noise impacted home must be taken into consideration in the determination of reasonableness. Finally, since there is the possibility of financial impact on those properties that are considered benefited by the construction of noise abatement, an [sic] 60 percent approval rate of the mitigation measures by the same benefited property owners is expected.

c) The noise analysis procedures in existence "optimize" the cost effectiveness of sound mitigation barriers, including their height. If very tall sound barriers would have to be located close to impacted receptors, and would have negative visual and/or property value impacts, the sound barrier may be considered not to be reasonable. The classification of the road, the right of way width, and the proposed features on the opposite side of the road will be considered in making a determination of reasonableness.

d) Reasonableness will take into consideration the effect of a sound barrier on environmental and historic resources.

e) It is expected that fiscal constraints will result in the fact that not all-feasible and reasonable road segments can be implemented in a given year. The County Council will need to prioritize which projects will be implemented in a given year, given the budgetary allocations to the noise abatement program. Some communities may elect to have alternative measures be implemented instead of the "optimized wall". Wooden fences and / or landscaping maybe[sic] alternatives available to the community for implementation by the County. In these cases, public funding will be 100 percent, except for any possible right of way needs. It is expected that necessary easements will be given to the County at no cost.

Discussion:

Both the State and County set a "cost per benefit" limit at $50,000. This limit will have to be periodically reviewed and/or adjusted to meet growing design and construction costs. Notable is that the State will consider the average cost per benefit of multiple noise barriers in a given project, if one or more of the barrier(s) exceed $50,000 per benefit, if no barrier in the project exceeds $100,000 per benefit, and the average cost per benefit for the entire project is less than $50,000.

The State requires that owners of 75% of the benefited residences approve proposed noise mitigation; the County requires 60% approval. The City will need to determine its own community approval requirement as part of its Transportation Noise Policy.

The State's comparison of facility design-year "build" vs. "no-build" noise levels allows for logical consideration of what noise levels *would be* if the facility were not altered. In many cases, altering highway (or rail transit) alignments does not noticeably increase resultant sound levels in the design-year condition. In this manner, the State considers noise mitigation for new or altered highway alignments if the resulting alignment actually *increases* the resulting sound levels >3dBA over design-year sound levels of the unimproved highway. The City of Rockville will have to consider whether or not such logic is suitable for its needs and the welfare of its citizens.

The State considers a residential property's eligibility date as the date of construction. The County takes into consideration a residential property's date of purchase. The State places the responsibility of provisions for noise abatement for new development on local jurisdictions. In turn, the County dictates that developers "prevent the creation of noise impacts when proposing residential development adjacent to roadways likely now or in the future". Given the rate of new construction within City limits, and the age of most existing neighborhoods with respect to highways and rail facilities within City limits, the City must determine the extent to which it will fund transportation noise abatement study and implementation. The City of Rockville is encouraged to adopt noise-favorable zoning and design criteria for new residential development projects.[2]

Both MDSHA and MCDPWT policies include provisions for landscaping, screening, and/or privacy fences in lieu of traditional or unreasonable transportation noise abatement measures. Landscaping may provide psychological improvements by removing noise source(s) from sight; however, it typically provides little noise level reduction. The common consideration of noise with respect to vegetation is "if you can see it, you can hear it". The effect of seasonal foliage changes upon equivalent sound levels is also minimal, since most leaves do not attenuate sound frequencies below 2000Hz (the frequency at which the wavelength is approximately the same size as the circumference of a leaf). With or without leaves, a dense stand of trees thirty feet thick will provide approximately zero decibels of sound level attenuation; a dense stand of trees three-hundred feet thick will provide 10 decibels of attenuation – the maximum for forestation of any thickness[3]. It is recommended that the City only consider landscaping and privacy fencing into consideration only in the absence of feasible and/or reasonable noise mitigation measures, or in response to community opposition to traditional transportation noise mitigation measures.

[2] U.S. Department of Housing and Urban Development – Office of Community Planning and Development, The Noise Guidebook, U.S. Government Printing Office. Washington, D.C, March 1985.
[3] Harris, Cyril M., Ph.D. Handbook of Noise Control. McGraw-Hill. New York. 1979. p 3-8.

C.5 Sound Barrier Design:

FHWA:

FHWA Highway Traffic Noise Analysis and Abatement Policy and Guidance provides several recommendations regarding appropriate sound barrier design considerations, including: aesthetics (type, height, surface, vertical and horizontal relationships to receivers), driver safety, noise reflections, and graffiti. The TNM software package can evaluate barrier-to-receiver relationships and noise reflections. Two good references on sound barrier design are the American Association of State Highway and Transportation Officials (AASHTO) Subcommittee on Bridges and Superstructures' "Guide Specifications for Structural Design of Sound Barriers" (1992), and FHWA's "Highway Noise Barrier Design Handbook" (2000).

MDSHA:

MDSHA Statewide Highway Noise Program Appendix C: Technical Design and Performance Criteria for Highway Sound Barrier Projects cites three general design and performance goals:

> A minimum insertion loss (noise reduction) of 7-10 decibels (dBA) at all critical sensitive receptors, (desirable goal as close to 10dBA as practical)
>
> Achieve "with-barrier" noise levels below the SHA Noise Impact Threshold (NIT) level of 66dBA
>
> Achieve a certain degree of uniformity (within approximately 3dBA) of "with-barrier" noise levels throughout the project area at critical sensitive receptors. Every effort should be made to avoid "hot spots" where noise levels in one area are substantially higher than those in adjacent, surrounding areas.

MCDPWT:

MCDPWT Highway Noise Abatement Policy cites concurrence with accepted Federal and State design practices for sound barriers, specifying that noise abatement designs provide at least 7dBA in noise level reduction for impacted residences.

CITY OF ROCKVILLE

TRANSPORTATION NOISE STUDY
FINAL REPORT – APPENDIX D:
UNDEVELOPED LANDS

April 15, 2005

Prepared for

City of Rockville, Maryland

Prepared by

Rummel, Klepper & Kahl, LLP

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Introduction

Transportation noise is a product of the close proximity of residents, businesses, and public facilities to roads, rail lines and in some cases, air-traffic patterns. The severity of residential transportation noise impacts depends upon the magnitude of sound energy transmitted from the noise sources (traffic, transit, etc.) to receivers (exterior and interior residential areas). The number of residential transportation noise impacts depends upon residential density (the number of residences in an impacted area) and source noise level intensity (the size of the impacted area).

Like many urban centers, the City of Rockville must adapt the ways in which land is used to accommodate the needs and welfare of the public and private concerns of which it is composed. Noise control and mitigation considerations are a prudent part of the process by which land use is determined. Since transportation noise will not likely be eliminated, it should be mitigated. With respect to land use within the City of Rockville – for example, those lands designated as “Rockville Pike Residential” and “Rockville Pike Mixed-Use Development”, there are several neighborhood planning and architectural design considerations that may be instituted that will reduce the transmission of transportation noise to sensitive receptors.

The purpose of this text is to make recommendations to the City of Rockville for consideration during the development of its transportation noise policy and/or City building code requirements. This text includes only general recommendations and should not be considered a comprehensive analysis or guideline.

D.1 Exterior Noise Design Considerations

Effective neighborhood / community planning can greatly reduce transmission of transportation noise to the outer walls of residences. Use of buffer areas, elevation changes, building layouts, etc. can absorb and/or reflect transportation noise energy.

Sound Barriers:

Sound barrier design(s) should be created in accordance with USDOT FHWA guidelines, safety and engineering requirements established by the American Association of State Highway and Transportation Officials (AASHTO), as well as the requirements of applicable government agencies, professional associations, and public committees.

Earth Berm Sound Barriers:

Earth berm sound barriers can be an effective means by which to reduce transportation noise transmission. Earth berms are frequently used as areas upon which to plant small trees, shrubbery, grasses, and other visually appealing, low-maintenance landscaping. The fill materials and landscaping (if any) used to construct earth berm sound barriers usually require less initial investment and involve lower maintenance costs than noise wall sound barriers. However, earth berms require considerable land area – they are at least four times as wide as they are tall. Earth berm placement at or near property boundaries, preferably near the roadway or rail transit right-of-way, provides the greatest noise reduction, but also requires the largest amount of dedicated space. Earth berm placement at or near building locations provides good noise reduction and usually reduces the size of the berm footprint, but can create undesirable negative drainage conditions.

Noise Wall Sound Barriers:

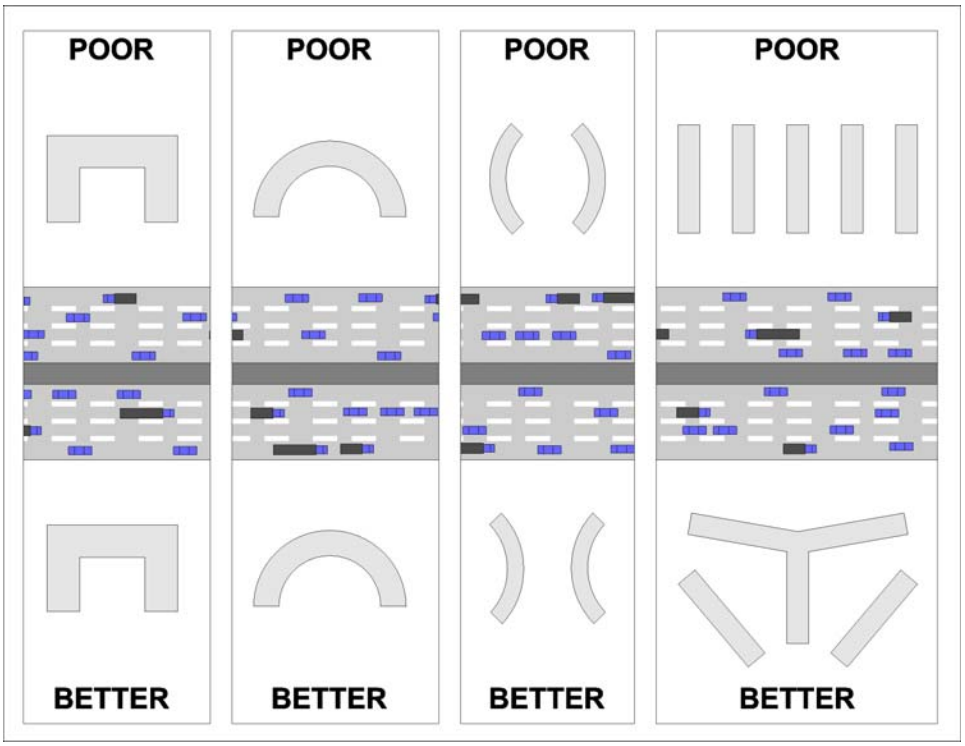
Like earth berms, noise wall sound barriers are most effective when placed near the noise source (roadway, rail transit line, etc.) or near the receiver. Noise walls occupy very little land area and can typically be constructed to be much taller than earth berms. Noise walls may be constructed of many materials – even transparent materials – that significantly absorb and/or reflect unwanted sound energy. Noise walls also provide a visual barrier, but typically do not provide the aesthetic appeal of earth berms. The most effective noise wall systems are typically the most expensive. In comparison to concrete panel noise walls, more aesthetically appealing noise wall systems such as laminated wood or stacked-planter systems either require more maintenance, are more expensive, or both.

Community / Neighborhood Planning:

Building Arrangement:

Building shape and arrangement can significantly affect community noise environment – especially for neighborhoods and communities with multi-story residences. Figure D.1: Neighborhood Building Shapes and Arrangements[1], below, illustrates a few examples of acoustically favorable and undesirable neighborhood building layouts.

Figure D.1: Neighborhood Building Shapes and Arrangements



Urban Community Land Use:

Placement of buffer areas such as open lawns, forested areas, and parking lots[2] on the community borders will result in lower sound levels at the closest receptors than if those receptors were closer to the transportation noise source(s). Placing common areas such as pools, tennis courts, basketball courts, and playgrounds on community borders near transportation sources will also distance transportation noise from residences; however, these are exterior areas of frequent human use that may require low

[1] Adapted from U.S. Department of Housing and Urban Development – Office of Community Planning and Development, The Noise Guidebook, U.S. Government Printing Office, Washington, D.C., March 1985, p32.

[2] Although sound absorption across hard surfaces such as asphalt and concrete is significantly less than sound absorption across soft ground or vegetation, sound pressure energy will still dissipate over the expanse of parking lots. Benefits of sound energy surface absorption become negligible for residential condominiums and apartment units several stories above ground elevation.

exposure to transportation noise to be considered enjoyable. Also, assigning building usage that creates distance and physical obstructions between noise sources and the most sensitive receivers will help reduce transportation impacts. Locating the leasing/sales office, maintenance building, parking garage, fitness center, etc., near the community property borders will maximize the buffer between transportation noise sources and residences.

D.2 Interior Noise Design Considerations

Frequently, consideration of the exterior noise environment is not practical in urban residential design. Land is scarce and/or expensive, and the result is that the exterior walls of many residences are near and direct view of transportation noise sources. If noise must be allowed to reach exterior walls, building design measures should be implemented to prevent noise transmission to the living spaces inside. The primary focus of preventing noise transmission to interior living spaces should be placed upon design and construction of exterior walls, HVAC systems, windows, and doors. The City is encouraged to research and adopt minimum Sound Transmission Class (STC) requirements for exterior walls that are exposed to transportation (and other significant) noise sources.

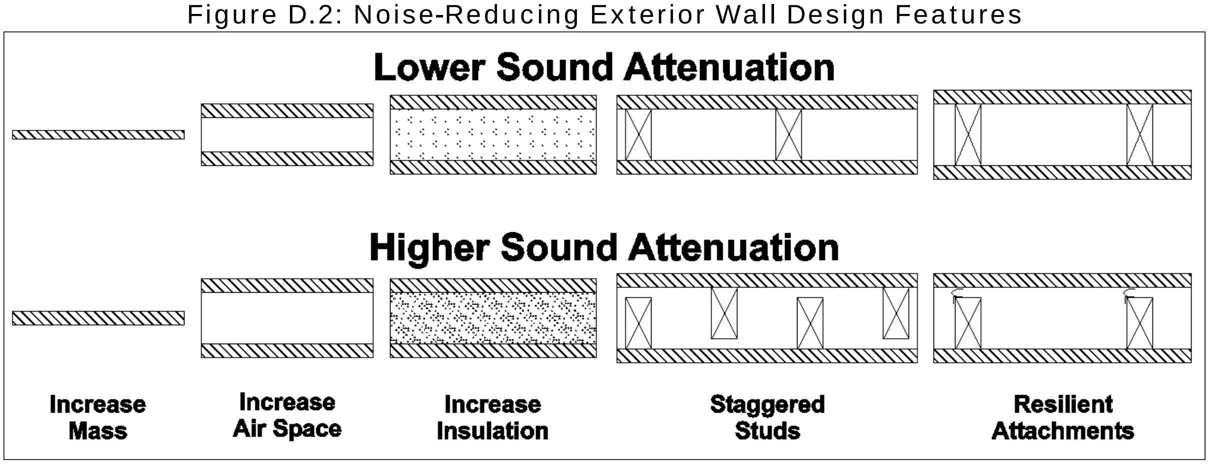
<u>Exterior Walls:</u>

<u>Walls:</u>

Increasing the mass and stiffness of exterior walls with direct exposure to transportation noise sources will typically decrease the amount of sound energy that passes through it. It is recommended that exterior walls directly exposed to transportation (and other) noise sources should be constructed of hard materials such as concrete, brick, stone, or cinder blocks.

If for economic and/or aesthetic reasons, use of less-dense materials such as wood or vinyl siding must be used in exterior walls facing transportation noise sources, other design features may be implemented to prevent noise transmission to the interior living spaces. Some of these include increasing the mass of the wall itself (e.g. double-sheets of plywood), increasing the air space between the exterior and interior wall surfaces, increasing the density of insulating material inside the wall, staggering studs to mechanically separate the exterior wall from the interior wall, and the use of resilient wall surface attachments (see Figure D.2: Noise-Reducing Exterior Wall Design Features, below).[3]

Figure D.2: Noise-Reducing Exterior Wall Design Features



[3] Adapted from U.S. Department of Housing and Urban Development – Office of Community Planning and Development, <u>The Noise Guidebook</u>, U.S. Government Printing Office, Washington, D.C., March 1985, p33.

Heating, Ventilation and Air Conditioning (HVAC):
If at all possible, intake or exhaust ducts should not terminate on external walls that face and/or have direct exposure to transportation noise sources. Wall-mounted air conditioning units should not be installed on walls that face and/or have direct exposure to transportation (or other) noise sources. The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) recommends application of the following basic steps during the design process to reduce HVAC noise and noise transmission through HVAC systems:[4]

- Select fans based on their noise characteristics
- Design duct systems for low turbulence and low noise
- Specify the most effective noise control product for a given application
- Select and properly locate central plant equipment
- Select the proper type of vibration isolator for a given application
- Correct noise problems in pumps, piping systems, mechanical rooms, and outdoor equipment

Doors and Windows:
Even if exterior walls are constructed of dense materials, sound energy may still pass through door and windows – even if they are closed. Many door and window manufacturers produce sound-absorptive items. In noise-sensitive areas and/or applications where exterior walls are exposed to transportation noise sources, it is recommended that products specifically manufactured as sound-insulating windows and doors be implemented. Furthermore, it is recommended that doors be installed with the use of a gasketed door stop and either weather stripping or a drop bar threshold closer (automatic door stop) to prevent noise passage around door edges.[5]

Interior Design Considerations:
If implementing noise-reducing design features to exterior walls exposed to noise sources is not feasible or does not sufficiently reduce interior noise levels, additional design measures may be required to provide a satisfactory living environment.

Interior Walls:
The same design principles that reduce sound transmission through exterior walls are effective for interior walls. Interior walls in rooms that face transportation (or other) noise sources should be constructed of dense materials in a fashion that will make them as stiff as possible. Adding a second layer of drywall (gypsum or comparable wallboard) and adding fiberglass insulation to interior walls are two effective means by which sound transmission will be significantly reduced. For example, an interior wall constructed of ½" gypsum wallboard on each side of 2x4 (nominal) wooden studs on 16" centers has an approximate sound transmission class (STC) of 37. Replacing the ½" gypsum wallboard with two layers of five-eighths inch wallboard on each side will increase the wall's STC to 44.[6]

Interior Flooring:
Where exterior noise transmission into interior living spaces is a concern, use of carpet, cork, linoleum, or similarly soft materials will aid in reducing noise transmission. Use of ceramic tile, marble, hardwood floors, etc., is not recommended for interior room areas where noise levels diminish the quality of living.

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[4] ASHRAE Learning Institute, October 20, 2003.
[5] Harris, Cyril M., Ph.D. Handbook of Noise Control. McGraw-Hill, New York, 1979, p22-15, and U.S. Department of Housing and Urban Development – Office of Community Planning and Development, The Noise Guidebook, U.S. Government Printing Office, Washington, D.C., March 1985, p36.
[6] Hoover & Keith, Inc., Noise Control for Buildings and Manufacturing Plants, p5-7. Note: STC does not represent actual decibel reduction. STC is a metric of sound transmission heavily weighted about the 500Hz, 1000Hz, and 2000Hz frequency octave bands – the frequency range of most human speech (see Appendix D: Glossary of Terms).

Interior Room Shape:
Whether or not external noise sources impact the quality of life inside a residence, interior rooms should be dimensioned to reduce noise reflections. Square rooms - including rooms that have one or more horizontal dimensions equal to their height – should be avoided. For example, a 17' x 15' (255 ft^2) room with 9' ceilings will be much less likely to reverberate sounds than a 16' x 16' (256 ft^2) room with 9' ceilings.

Interior Room Designation:
Another means by which to reduce the impact of exterior noise sources on the quality of the interior noise environment is to implement architectural designs that place noise sensitive living spaces with little or no direct exposure to the external noise source. Foyers, kitchens, bathrooms (and to a lesser degree dining rooms) should be arranged near the outside walls that are near or face the external noise source. Bedrooms, nurseries, living rooms, studies, etc., should be arranged without exposure to impacting noise sources.[7]

[7] U.S. Department of Housing and Urban Development – Office of Community Planning and Development, The Noise Guidebook, U.S. Government Printing Office, Washington, D.C., March 1985, p7.

CITY OF ROCKVILLE

TRANSPORTATION NOISE STUDY
FINAL REPORT – APPENDIX E:
GLOSSARY OF TERMS

April 15, 2005

<u>Prepared for</u>

City of Rockville, Maryland

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A-Weighting
The weighting network used to account for changes in level sensitivity as a function of frequency. The A-weighting network de-emphasizes the high (≥6.3kHz) and low (≤1kHz) frequencies, and emphasizes the frequencies between 1kHz and 6.3kHz, in an effort to simulate the relative response of the human ear.

Acoustic Energy
Commonly referred to as the mean-square sound-pressure ratio, or sound energy. Acoustic energy is the square of the ratio of the mean-square sound pressure and the reference mean-square sound pressure of 20μPa, the threshold of human hearing. It is arithmetically equivalent to $10^{(SPL/10)}$, where SPL is the sound pressure level, expressed in decibels.

Ambient Noise
All-encompassing sound that is associated with a given environment

Amplitude
The maximum value of a sinusoidal quantity measured from peak to peak

Artificial Noise Source
An acoustical source that is controlled in position and calibrated as to output power, spectral content, and directivity

Background Noise
All-encompassing sound of a given environment without the sound source of interest

Bay
The area between two posts in a noise barrier system. This area can contain full height or stacked panels, cast in place panels, or other types of assembled panel components.

Berm
A natural or constructed mound or bank of earth

Caisson
A wood, metal or concrete casing sunk or constructed below ground or water level

Contour
Graphical plot consisting of a smooth curve, statistically regressed through points of equal level

Day-Night Average Sound Level (DNL, denoted by the symbol, L_{dn})
A 24-hour time-averaged equivalent sound level adjusted with a 10-decibel penalty for nighttime noise occurring between 10:00 p.m. and 7:00 a.m. For 24-hour data collection over equal interval periods, L_{dn} is calculated by the equation:

$$L_{dn} = 10*\log_{10}\left\{\left[\Sigma_{0700\text{ - }2159}(10^{(Lday/10)}) + \Sigma_{2200\text{ - }0659}\ (10^{((Lnight+10)/10)})\right] / N\right\}\ (dB)$$

where:
L_{day} = noise monitoring data point taken between 7:00 a.m. and 9:59 p.m., in decibels
L_{night} = noise monitoring data point taken between 10:00 p.m. and 6:59 a.m., in decibels
N = total number of data points throughout 24-hour monitoring period

Daytime Hours
The weekday and weekend hours typically defined as the period from 7:00 a.m. through 6:00 p.m. Monday through Friday and 9:00 a.m. through 6:00 p.m. Saturday, except Holidays. Daytime work hour designation is subject to the definition of appropriate government agencies or applicable specification(s).

Decibel (dB)
The dimensionless unit of sound level measurement. The number of decibels is calculated as ten times the base-10 logarithm of the square of the ratio of the mean-square sound pressure (often referred to as frequency weighted), and the reference mean-square sound pressure of 20μPa, the threshold of human hearing.

Diffuse Sound Field
A space with many reflecting surfaces and little sound absorption, a sound field with boundaries that exert considerable influence on the sound waves within it

Equivalent Sound Level (L_{eq})
Ten times the base-10 logarithm of the square of the ratio of time-mean-square, instantaneous sound pressure, during a stated time interval, T (where $T=t_2-t_1$), divided by the squared reference sound pressure of 20μPa, the threshold of human hearing. L_{eq} is ten times the base-10 logarithm of the arithmetic average of the decibel sound levels over the stated time interval, which for consistent monitoring intervals is calculated by the equation:

$$L_{eq} = 10*\log_{10}\left\{ [\Sigma_{i = 1 \text{ to } N} (10^{(Li/10)})] / N \right\} \text{ (dB)}$$

Evening Hours
The weekday and weekend hours typically defined as the period from 6:00 p.m. through 10:00 p.m. Monday through Friday, except Holidays. Evening work hour designation is subject to the definition of appropriate government agencies or applicable specification(s).

Far Field
That portion of a point source's sound field in which the sound pressure level from the point source decreases by 6 decibels per doubling of distance from the source, i.e., spherical divergence. For a line source, the far field is the portion of the sound field in which the sound pressure level decreases by 3 decibels per doubling of distance.

Fast Response
Specifies a time constant of 0.125 seconds for the root mean square (RMS) used by a sound level meter, in accordance with ANSI 5.1.4 Standards

Frequency
The number of wave cycles per second or the number of wavelengths that has passed by a stationary point in one second, expressed by the dimension Hertz (Hz) in units of inverse seconds (s^{-1})

Frequency Weighting
A method used to account for changes in sensitivity as a function of frequency. Three standard weighting networks, A, B, and C, are used to account for different responses to sound pressure levels. Note: The absence of frequency weighting is referred to as "flat" response. See also A-weighting.

Ground Effect
The change in sound level due to intervening ground between source and receiver. Ground effect is a relatively complex acoustic phenomenon, which is a function of ground characteristics, source-to-receiver geometry, and the spectral characteristics of the source.

Ground Impedance
A complex function of frequency relating the sound transmission characteristics of a ground surface type

Hard Ground
Any highly reflective surface in which the phase of the sound energy is essentially preserved upon reflection. Examples of hard ground include water, asphalt, and concrete.

Hertz (Hz)
The unit of frequency measurement in dimensions of inverse seconds (s^{-1})

Holiday
Any non-working day, as designated by appropriate government agency or specification

Insertion Loss (IL)
The sound level at a given receiver before the construction of a barrier minus the sound level at the same receiver after the construction of the barrier

L_{10}
The sound level exceeded 10 percent of a specific time period

L_{90}
The sound level exceeded 90 percent of a specific time period. L_{90} is commonly used as a metric of "background noise".

L_{eq}
See Equivalent Sound Level

L_{max}
The maximum measured sound level at any instant in time for a specific time period

Line-of-Sight
Refers to the direct path from the source to receiver without any intervening objects or topography

Line Source
Multiple point sources moving in one direction, e.g., a continuous stream of roadway traffic, radiating sound cylindrically. Sound levels measured from a line source decrease at a rate of 3 decibels per doubling of distance.

Lot-Line
The line separating one parcel of land from another

Monitoring Period
Time period over which noise measurements are obtained

Near Field
The sound field between the source and the far field. The near field exists under optimal conditions at distances less than four times the largest sound source dimension.

Nighttime Hours
The weekday and weekend hours typically defined as the period from 10:00 p.m. through 7:00 a.m. Monday through Friday and 6:00 p.m. through 7:00 a.m. on Saturday, Sunday, and holidays. Nighttime work hour designation is subject to the definition of appropriate government agencies or applicable specification(s).

Noise
Any unwanted sound

Noise Barrier
The structure, or structure together with other material, that potentially alters the noise at a site from a BEFORE condition to an AFTER condition

Noise Reduction Coefficient (NRC)
A single-number rating of the sound absorption properties of a material; it is the arithmetic mean of the Sabine absorption coefficients at 250, 500, 1000, and 2000 Hz, rounded to the nearest multiple of 0.05

Noise Reduction Goal
The amount of noise reduction that is desired

Normal Incident (Sound)
Sound waves that strike a receiver at an angle perpendicular, or normal, to the angle of incidence

Nuisance Noise
Noise that annoys, disturbs, or has the potential to do so

Parallel Barriers
Two or more noise barriers flanking both sides of a roadway

Parapet
Low walls, or railings or a combination of both that are located along the outside edges of bridge decks designed to prevent vehicles from running off the sides of the bridge

Perturbation
The height increment that a noise barrier's input height is increased (perturbed up) or decreased (perturbed down) during the barrier design process

Point Source
A noise source that radiates sound spherically. Sound levels measured from a point source decrease at a rate of 6 decibels per doubling of distance.

Random Incident (Sound)
Sound waves that strike a receiver randomly from all angles of incidence. Random incident waves are common in a diffuse sound field.

REMEL
Reference Energy Mean Emission Level

Right-of-Way (ROW)
The entire strip or area of land used for highway purposes

Sabine Absorption Coefficient (S_{ab})
Absorption coefficient obtained in a reverberation room by measuring the time rate of decay of the sound energy. These measurements are performed in accordance with the American Society of Testing and Materials (ASTM) Standard C 423-90a.

Slow Response
Specifies a time constant of greater than 0.125 seconds – typically 1.0 seconds – for the root mean square (RMS) used by a sound level meter, in accordance with ANSI 5.1.4 Standards

Soft Ground
Any highly absorptive surface in which the phase of the sound energy is changed upon reflection

Sound Absorption Coefficient (SAC)
The ratio of the sound energy, as a function of frequency, absorbed by a surface, and the sound energy incident upon that surface (See also Sabine Absorption Coefficient)

Sound Energy
See Acoustic energy

Sound Pressure
The root-mean-square of the instantaneous sound pressures during a specified time interval in a stated frequency band

Sound Pressure Level (SPL)
Ten times the base-10 logarithm of the square of the ratio of the mean-square sound pressure, in a stated frequency band (often weighted), and the reference mean-square sound pressure of 20μPa, the threshold of human hearing, and is calculated by the equation:

$$SPL = 10*\log_{10}(p^2/p_{ref}^2) \quad (dB)$$

where:
- p = mean-square sound pressure
- p_{ref} = reference mean-square sound pressure of 20 μPa

Sound Transmission Class (STC)
A single-number rating used to compare the sound insulation properties of barriers. STC is derived by fitting a reference rating curve to the sound transmission loss (TL) values measured for the 16 contiguous one-third octave frequency bands with nominal mid-band frequencies of 125Hz to 4kHz inclusive, by a standard method. The reference rating curve is fitted to the 16 measured TL values such that the sum of deficiencies (TL values less than the reference rating curve), does not exceed 32 decibels, and no single deficiency is greater than 8 decibels. The STC value is the numerical value of the reference contour at 500Hz.

Transmission Loss (TL)
The loss in sound energy, expressed in decibels, as sound passes through a barrier or a wall. Measurements to determine a material's TL should be made in accordance with ASTM Recommended Practice E413-87, and is calculated by the equation:

$$TL = 10*\log_{10}\left[10^{(SPLs/10)} / 10^{(SPLr/10)}\right] (dB)$$

where:
- SPL_s is the sound pressure level on the source side of the barrier
- SPL_r is the sound pressure level on the receiver side of the barrier.

Utilities
Transmission and distribution lines, pipes, cables and other associated equipment used for public services including, but not limited to, electric transmission and distribution, lighting, heating, gas, oil, water, sewage, cablevision, data communications, and telephone

Wavelength
The perpendicular distance between two wave fronts in which the displacements have a difference in phase of one complete period